

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA



THESIS

**THE FUTURE OF THE SWEDISH DEFENSE
INDUSTRY: STRATEGIES FOR
COMPETITIVENESS AND SUPPORT**

by

Staffan H. Sjoberg
December, 1995

Principal Advisor:
Associate Advisor:

Roger D. Evered
Keith Snider

Approved for public release; distribution is unlimited.

19960329 095

DTIC QUALITY INSPECTED 1

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

| | | | |
|---|--|---|--|
| 1. AGENCY USE ONLY (<i>Leave blank</i>) | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED | |
| | December 1995 | Master's Thesis | |
| 4. TITLE AND SUBTITLE THE FUTURE OF THE SWEDISH DEFENSE INDUSTRY: STRATEGIES FOR COMPETITIVENESS AND SUPPORT | | | 5. FUNDING NUMBERS |
| 6. AUTHOR(S) STAFFAN H. SJOBERG | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000 | | | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER |
| 11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. | | | |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited. | | 12b. DISTRIBUTION CODE | |
| 13. ABSTRACT (<i>maximum 200 words</i>) In the light of the new geopolitical developments and the end of the cold war, the Swedish government is downsizing the Armed Forces. The proposed organization and spending level will not be able to sustain a domestic defense industry of current size. In an attempt to overcome this, there are different industry initiated strategies available. This thesis evaluates three of them: International Cooperation, Concentration and Consolidation, Integration and/or Conversion, by using evaluation criteria derived from the future needs of the Swedish Armed Forces. The criteria are: Produce competitive systems, Maintain a broad defense industrial base for growth, Support build-up and mobilization, Provide technology unavailable from abroad, Support and modify systems in inventory and Limit foreign dependence. The evaluation shows no single strategy fulfills all needs. International cooperation is the strategy that best meets the needs. The Swedish Defense Industry must choose its own strategy to adapt to the new environment. It may include elements of all three strategies, but given foreseeable spending levels, it is impossible to pursue all three simultaneously. It is therefore necessary for the government and the Armed Forces to clearly communicate future priorities and requirements in order to facilitate the process. | | | |
| 14. SUBJECT TERMS DEFENSE INDUSTRY STRATEGIES | | | 15. NUMBER OF PAGES 112 |
| | | | 16. PRICE CODE |
| 17. SECURITY CLASSIFICATION OF REPORT Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified | 20. LIMITATION OF ABSTRACT UL |

Approved for public release; distribution is unlimited.

**THE FUTURE OF THE SWEDISH DEFENSE INDUSTRY: STRATEGIES
FOR COMPETITIVENESS AND SUPPORT**

Staffan H. Sjoberg

Major, Swedish Army

M. S. Engineering, The Swedish Armed Forces Staff and War College, 1989

Submitted in partial fulfillment
of the requirements for the degree of

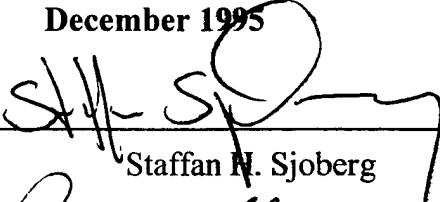
MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

from the

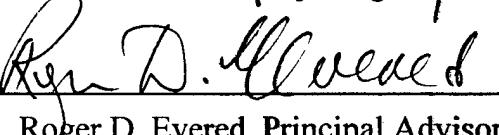
NAVAL POSTGRADUATE SCHOOL

December 1995

Author:


Staffan H. Sjoberg

Approved by:


Roger D. Evered, Principal Advisor


Keith Snider, Associate Advisor


Reuben T. Harris

Reuben T. Harris, Chairman
Department of System Management

ABSTRACT

In the light of the new geopolitical developments and the end of the cold war, the Swedish government is downsizing the Armed Forces. The proposed organization and spending level will not be able to sustain a domestic defense industry of current size. In an attempt to overcome this, there are different industry initiated strategies available. This thesis evaluates three of them: International Cooperation, Concentration and Consolidation, Integration and/or Conversion, by using evaluation criteria derived from the future needs of the Swedish Armed Forces. The criteria are: Produce competitive systems, Maintain a broad defense industrial base for growth, Support build-up and mobilization, Provide technology unavailable from abroad, Support and modify systems in inventory and Limit foreign dependence. The evaluation shows no single strategy fulfills all needs. International cooperation is the strategy that best meets the needs. The Swedish Defense Industry must choose its own strategy to adapt to the new environment. It may include elements of all three strategies, but given foreseeable spending levels, it is impossible to pursue all three simultaneously. It is therefore necessary for the government and the Armed Forces to clearly communicate future priorities and requirements in order to facilitate the process.

TABLE OF CONTENTS

| | |
|--|----|
| I. INTRODUCTION | 1 |
| A. AREA OF RESEARCH | 1 |
| B. ASSUMPTIONS AND LIMITATIONS | 2 |
| C. RESEARCH QUESTIONS | 2 |
| D. METHODOLOGY | 3 |
| E. ORGANIZATION | 3 |
| II. BACKGROUND | 7 |
| A. REASONS FOR A SWEDISH DEFENSE INDUSTRY BASE | 7 |
| 1. Non-aligned Policy | 7 |
| 2. World War II | 7 |
| 3. Unique Requirements | 8 |
| 4. Access to Technology | 8 |
| B. SUMMARY | 8 |
| III. THE SWEDISH DEFENSE INDUSTRY TODAY | 11 |
| A. STRUCTURE | 11 |
| 1. Ericsson AB | 11 |
| 2. Celsius AB | 12 |
| 3. SAAB AB | 14 |
| 4. Hagglunds Vehicle AB | 15 |
| 5. Volvo Aero Corporation | 15 |
| 6. Akers Krutbruk Protection AB | 15 |
| B. BASIC FACTS | 16 |
| 1. Capital Turnover | 16 |
| 2. Exports | 16 |

| | |
|---|----|
| 3. Manpower | 16 |
| 4. Market Share | 16 |
| 5. Competition | 17 |
| 6. Capabilities | 17 |
| C. FOREIGN DEPENDENCE | 17 |
| D. INTERNATIONAL COOPERATION | 17 |
| E. FACTS ABOUT MILITARY R&D IN SWEDEN | 18 |
| IV. ARMS PRODUCTION AND TRADE - GENERAL TRENDS | 21 |
| A. BACKGROUND | 21 |
| B. EXCESS CAPACITY | 22 |
| C. GLOBALIZATION | 23 |
| D. RESTRUCTURING | 25 |
| E. NEW COMPETITION | 25 |
| F. OTHER MEASURES | 26 |
| G. OFFSET | 27 |
| H. SWEDISH EXAMPLES | 29 |
| V. GOVERNMENT AND ARMED FORCES POLICY | 31 |
| A. THE SWEDISH ARMED FORCES TODAY | 31 |
| B. PRESENT DEFENSE POLICY | 32 |
| C. GOVERNMENT POLICY REGARDING THE DEFENSE INDUSTRY | 34 |
| D. THE ARMED FORCES' POLICY REGARDING THE DEFENSE INDUSTRY | 35 |
| E. THE ARMED FORCES' TECHNOLOGY STRATEGY | 36 |
| F. FOREIGN DEPENDENCE | 37 |
| 1. Background to Foreign Dependence | 37 |
| 2. Risks Involved | 38 |

| | | |
|---------------------------------|---|----|
| 3. | Reducing the Risks | 39 |
| G. | EXPORT REGULATIONS | 40 |
| H. | COMMITTEE PROPOSAL FOR 1996 DEFENSE DECISION | 41 |
| 1. | Environment | 41 |
| 2. | Swedish Implications | 43 |
| 3. | Conclusions | 44 |
| I. | SUMMARY | 44 |
| VI. INDUSTRY RESPONSE | | 49 |
| A. | BACKGROUND | 49 |
| B. | ALTERNATIVE STRATEGIES | 51 |
| 1. | International Cooperation Strategy | 51 |
| 2. | Consolidation and Concentration Strategy | 51 |
| 3. | Integration and/or Conversion Strategy | 52 |
| C. | STRATEGY I: INTERNATIONAL COOPERATION | 52 |
| 1. | Swedish Examples | 53 |
| D. | STRATEGY II: CONSOLIDATION AND CONCENTRATION | 54 |
| 1. | European Development | 56 |
| 2. | Swedish Examples | 57 |
| E. | STRATEGY III: INTEGRATION AND/OR CONVERSION | 59 |
| 1. | Swedish Examples | 62 |
| F. | SUMMARY | 63 |
| VII. EVALUATION | | 67 |
| A. | GOVERNMENT AND ARMED FORCES REQUIREMENTS | 67 |
| B. | GEOPOLITICAL SCENARIOS | 68 |
| 1. | Scenario 1: Move from Neutrality Policy Toward WEU or NATO | 68 |

| | | |
|---------------------------------|--|----|
| 2. | Scenario 2: New Tension in Former Soviet Union; Increased Risk for Invasion | 69 |
| 3. | Scenario 3: Non-military Threats | 70 |
| C. | SELECTION OF EVALUATION CRITERIA | 70 |
| D. | EVALUATION | 71 |
| 1. | Criteria I: Provide Competitive Systems for the Swedish Armed Forces | 71 |
| 2. | Criteria II: Support Build-up and Mobilization | 74 |
| 3. | Criteria III: Sustain a Broad Defense Industrial Base for Later Growth | 77 |
| 4. | Criteria IV: Provide the Armed Forces with Systems and Technology Unavailable from Abroad | 78 |
| 5. | Criteria V: Support and Modify Systems in Inventory | 81 |
| 6. | Criteria VI: Limit Foreign Dependence | 84 |
| E. | SUMMARY | 86 |
| VIII. CONCLUSIONS | | 89 |
| A. | INTERNATIONAL COOPERATION STRATEGY | 90 |
| B. | CONCENTRATION AND CONSOLIDATION STRATEGY | 90 |
| C. | INTEGRATION AND/OR DIVERSIFICATION STRATEGY | 91 |
| BIBLIOGRAPHY | | 95 |
| INITIAL DISTRIBUTION LIST | | 97 |

LIST OF FIGURES

| | |
|--|----|
| 1. Structure of Swedish Defense Industry | 11 |
| 2. The Budget for the Swedish Armed Forces. | 32 |
| 3. Scandinavia. | 42 |
| 4. Reduction of the Armed Forces. | 46 |

LIST OF TABLES

| | |
|---|----|
| 1. Differences Between Military and Civilian Manufacturers. | 50 |
| 2. Industrial Strategies for the Swedish Defense Industry. | 63 |
| 3. Evaluation Criteria | 71 |
| 4. Summary | 86 |

I. INTRODUCTION

A. AREA OF RESEARCH

How can the Swedish Defense Industry fulfill the needs of the Swedish Armed Forces and stay competitive in a rapidly changing market place? This thesis investigates alternative strategies for the Swedish Defense Industry to stay competitive in the new market conditions which prevail following the collapse of the former Soviet Union and the end of the cold war. An investigation of likely international and domestic defense market development over the next ten years will form the background for the analysis, which will compare alternative industry-initiated strategies. Recognition of the tightly coupled relationships among Swedish foreign, defense, and industrial policies are essential to the investigation.

The Swedish government determines the size of the Armed Forces, by far the largest and most important customer for the defense industry. Due to that fact, the view of the Swedish government regarding future threat and defense spending levels, as well as foreign dependence, will be presented. Consequently, evaluation criteria derived from the Swedish military needs will be used as the basis for the comparison between alternative defense industry strategies. To get a broader view, other scenarios which consider possible geopolitical developments will be investigated. The final selection of evaluation criteria will be based on government and Armed Forces priorities.

The purpose of the research is to present and compare different strategies available to the Swedish Defense Industry, in order to fulfill the needs of the Swedish Armed Forces and stay competitive in the future, despite proposed lower defense spending in Sweden and a shrinking world market.

B. ASSUMPTIONS AND LIMITATIONS

The study is based on the following assumptions and limitations:

- Present government policy proposals will go into effect.
- Government intervention or subsidies will not be considered.
- The primary industry role will remain the same - supply the Swedish Armed Forces.
- The time frame for the study is the next ten years.

The study will not focus on details, or propose solutions for each and every firm. Instead it will analyze different general strategies in order to find a measure, or a mix of measures, that can be helpful to the defense industry.

C. RESEARCH QUESTIONS

The primary question this research addresses is:

- To what degree do alternative strategies, available to the Swedish Defense Industry, fulfill the future needs of the Swedish Armed Forces, and by doing so help the industry to sustain its competitiveness in a shrinking market environment?

To answer the primary question, it will be necessary to address the following subsidiary questions:

- Why does Sweden, a small neutral country, have a defense industry?
- What is the current state of the Swedish Defense Industry?
- What is likely to happen to the defense market, especially the domestic market?

- How will the changing market effect the Swedish Defense Industry?
- What are Swedish government intentions for defense policy?
- Which are the Swedish Armed Forces' future needs?
- Which industry-initiated strategies are available?
- How well do the strategies fulfill the needs?
- Which solution set is preferable given likely developments?

D. METHODOLOGY

To describe and analyze current and future trends for defense industries in Sweden and worldwide, as well as Swedish security policy, this research makes use of industry literature, trade publications, U.S. and Swedish government sources, and professional publications. Specific background information is provided by studies conducted by the Swedish defense industry itself, the Swedish government, and Armed Forces headquarters.

Current events as described in Defense News, Jane's Defence Weekly, Aviation Week and Space Technology, among others, are investigated and used in the research. In addition, the researcher has participated in the annual preparations for white papers to the Swedish Government regarding defense policy and the development of the Swedish Armed Forces. Unclassified background material and notes from this work have also been used.

E. ORGANIZATION

This research is organized to initially give a background to, and a picture of, the Swedish Defense Industry. It will then present a number of trends regarding arms trade and defense industries worldwide. In the next part the Swedish government's proposal for the

next defense decision will be presented, together with the Armed Forces' view, serving as the basis for how the largest and most important customer and the environment will develop in the next five to ten years. Finally different alternatives will be presented, compared and analyzed using evaluation criteria derived from the "reality" presented earlier.

Chapter I presents the study. Chapter II and III give a background to why Sweden built a defense industry in the first place, and the current structure and capability of today.

Chapter IV looks into today's global marketplace in terms of what is going on, which trends can be seen. Excess capacity, globalization, restructuring, new competitors, new pricing policies and offset will be discussed.

Chapter V will initially give an overview of the Swedish Armed Forces, the current Swedish government's view, and the corresponding defense policy. Following this, the Armed Forces' view regarding the Swedish Defense Industry and its importance to the Armed Forces will be examined. Since it is obvious in all scenarios that foreign dependence is an important issue, and will be even more so in the future, it will also be addressed. Finally, the government committee's proposed defense policy for the coming five years in view of the new security situation and its implications, will be presented.

Chapter VI will look into some available responses and strategies of companies involved in production of military systems. Three different strategies, synthesized from the prevailing trends, will be presented and discussed as possible approaches to the new environment. To exemplify, recent developments will also be presented as well as pros and cons for each alternative.

Chapter VII compares the different strategies presented in Chapter VI. The strategies will be compared by using selection criteria derived from the Swedish needs in the future, and they will be graded on how well they fulfill those demands. As a consequence of the method chosen, the study will not be able to predict which of the strategies that will be most successful in the marketplace. But it will show to what degree they fulfill the demands from

the Swedish government and Armed Forces. And since the defense industry also in the future will be dependent on the domestic market, it is reasonable that the result also gives an indication on the possibilities for success in the marketplace.

Chapter VIII discusses the findings, draws conclusions and proposes a strategy for the Swedish Defense Industry.

II. BACKGROUND

The Swedish defense industry has a long experience in designing and manufacturing armaments - for some companies more than 300 years. The current structure and coverage, however, dates from World War II when Sweden established its independence from foreign supply sources. Since then the defense industry has been a mainstay of Sweden's security policy.¹ This chapter will present some of the most important reasons for why Sweden today has a broad and competitive defense industry.

A. REASONS FOR A SWEDISH DEFENSE INDUSTRY BASE

The base of the Swedish defense industry is broad. There are only a handful of countries, including Sweden, that have the ability to design, develop and manufacture advanced weapon systems capable of fulfilling the strict requirements of the Army, Navy and Air Force. Why has Sweden, a small country with limited resources, built this industrial capability? Some reasons are suggested in the following discussion.

1. Non-aligned Policy

For decades Sweden has occupied a strategically important role in northern Europe, sandwiched between the two superpowers. That fact, together with Sweden's wartime neutrality and peacetime non-alliance policies, placed great demands on defense capabilities. In order to give credibility to the policy of neutrality, it was considered important to demonstrate a strong will for independence from the two blocks.²

2. World War II

When the dark clouds began to gather over Europe in the 1930's, Sweden had a need to rebuild its defense capability. To do so with domestic sources was impossible, mostly due to an inadequate infrastructure. Furthermore, the expertise was not high enough in many areas.

An attempt to fulfill the military needs through import proved unsuccessful, since potential exporters were mobilizing for war, and kept their best equipment for domestic purposes. Thus, the only equipment available to Sweden was both expensive and outdated. Due to this experience of scarcity, the ability to develop, manufacture and support weapons systems domestically became necessary.

3. Unique Requirements

Sweden has unique requirements due to geography, climate, and the conscript system. Consequently, Swedish defense philosophy is in certain areas different from most other countries. The Air Force, for example, disperses the squadrons on bases using normal roads prepared in peacetime. This calls for special requirements on the systems. Fighter aircraft have to be able to land on an 800 meter runway. A domestic defense industry has the ability to tailor weapons systems to Sweden's unique circumstances from the beginning of the Research & Development (R&D) process.

4. Access to Technology

To gain access to first-rate technology that other countries are unwilling to export without restriction (e.g., electronic warfare equipment, sensors, encryption equipment), both military and government authorities believed it necessary to domestically build up and maintain capability in the restricted technologies.

B. SUMMARY

A domestic defense industry is able to support the Armed Forces in peacetime, crisis and war, reducing the nation's vulnerability to blockades or political pressure. This is especially important since Sweden is non-aligned, and to a large degree must rely on its own capacity in a time of crisis. The structure of the Swedish Armed Forces relies on a nationwide mobilization system which requires a complex, multi-tiered, pre-positioned

infrastructure to support flexible response. The domestic industrial infrastructure must be capable of supplying the combination of pre-positioned and rapidly produced material necessary to respond to a variety of situations.

REFERENCES

1. Association of Swedish Defence Industries, The Swedish Defence Industry, 1994,
p. 4
2. Association of Swedish Defence Industries, The Swedish Defence Industry, 1994,
p. 3

III. THE SWEDISH DEFENSE INDUSTRY TODAY

A. STRUCTURE

This chapter will present the Swedish Defense Industry both in terms of structure and capability. The current structure of the Swedish Defense Industry is shown in Figure 1.

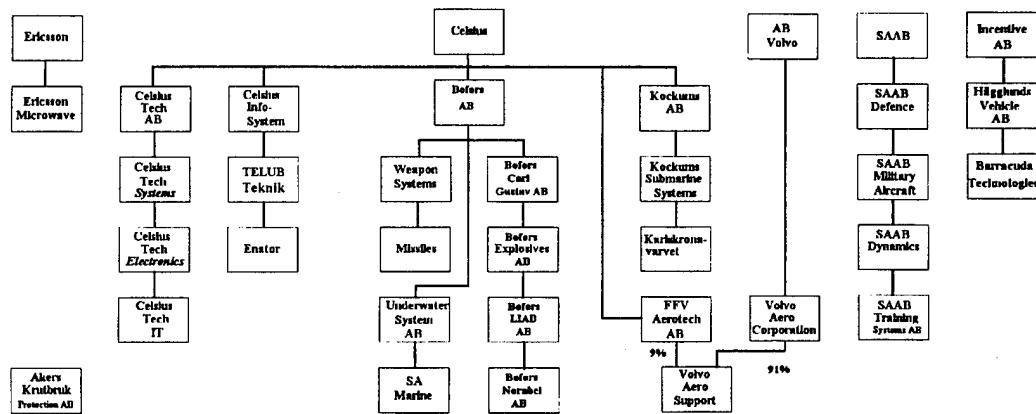


Figure 1. Structure of Swedish Defense Industry.¹

The Swedish Defense Industry today consists of three major groups of companies: Ericsson, Celsius, and SAAB. In addition to these three, there is Haggblunds Vehicle AB, a company within Incentive AB. Haggblunds Vehicle owns Barracuda Technologies. Akers Krutbruk Protection AB is a company standing outside any groups of companies. In the following, the companies' specialities and their origin will be described.

1. Ericsson AB

The Ericsson group has one company manufacturing defense products: Ericsson Microwave Systems AB. The company was formed by a merger between Ericsson Radio System AB and Ericsson Radar Electronics AB, on January 1, 1995. The core of Ericsson Microwave Systems AB's business is in the fields of sensors, communication and electronic

warfare equipment. The company creates complete systems of the components within each of those different fields of speciality.

The company's new name also indicates an increasing civil aim, based on its knowledge in high frequency and microwave technique. The number of employees is 2,100.

2. **Celsius AB**

Celsius Industrier AB and Celsius Information Systems AB are the two companies that make up Celsius AB. Celsius Industrier AB consists of Bofors AB, Kockums AB, FFV Aerotech and Celsius Tech. Under Celsius Information Systems there is TELUB.

a. **Bofors AB**

The company develops and produces a wide range of defense systems and has, with its subcompanies, qualifications in the following areas:

- Missiles, especially ground to air- and anti-tank missiles (Bofors Missiles).
- Guns, combat vehicles and munitions (Bofors Weapon System).
- Munitions, small arms ammunition and portable anti-tank weapons (Bofors Carl Gustaf).
- Powder and explosives (Bofors Explosives AB).
- Torpedoes and mines (Bofors Underwater Systems AB).

The number of employees is 3,000.

b. **Kockums AB**

Kockums has two subcompanies: Kockums Submarine and Karlskronavarvet. The company develops and produces mainly naval systems. Currently, the following products are manufactured:

- Submarines (The Gotland series),
- Missile ships,
- Mine-clearing vessels,
- Surface warfare ships and Army bridges.

There are 1,500 employees of which 800 are employed by Karskronavarvet.

c. Celsius Tech AB

Celsius Tech Systems and Celsius Tech Electronics are the two companies that constitute Celsius Tech AB. Celsius Tech Systems develops and manufactures combat and fire control systems for ships, ground based command and control systems for air defense, communication systems, and systems for air traffic control.

Celsius Tech Electronics develops and manufactures products for all branches in the areas of electronic warfare, avionics, telecommunications, fire control and optics, and airplane radio and microwave products. Celsius Tech AB has 2,000 employees.

d. TELUB

TELUB is a part of the Celsius group. Its business idea is to offer services from a non-manufacturer's point of view concerning efficiency in the customer's technical functions and systems. TELUB offers the following services:

- Technical support and documentation related to procurement, support and maintenance.
- Facility services.
- Maintenance and modification operations.

TELUB has 1,400 employees.

e. FFV Aerotech

FFV Aerotech is a maintenance and technical support company within the Celsius group. Its field is mainly concerned with military aircraft. The enterprise consists of:

- Hardware maintenance and maintenance modifications on aircraft systems and missiles.
- Technical services within maintenance/support.
- Speciality manufacturing, maintenance/support, spare parts production.
- Modifications and systems upgrading.

The number of employees is 1,400.

3. SAAB AB

The defense related company in the SAAB group is SAAB Defence. SAAB Defence has the subcompanies SAAB Military Aircraft, SAAB Dynamics, and SAAB Training Systems AB. SAAB Military Aircraft's largest business today concerns the development and manufacturing of the JAS 39 Gripen. The company has 2,800 employees.

SAAB Dynamics develops and manufactures products for all defense branches. Examples of products are:

- Navy missile systems and sub-systems for certain air-to-air missile programs.
- Electro optical fire control systems.
- Reconnaissance systems.
- Counter measure systems.
- Sights.

- Navigating systems for submarines.
- Laser firing simulators.
- Artillery simulators.
- Target material.

The company has 800 employees.

4. Hagglunds Vehicle AB

Hagglunds Vehicle AB develops and produces all-terrain vehicles and armored vehicles. The products are:

- All-terrain vehicles in several varieties.
- Combat vehicle 90, plus chassis renovation and modification of older combat vehicles.
- License manufacturing of the Leopard 2 tank.

The number of employees is 700.

5. Volvo Aero Corporation

Volvo Aero Corporation maintains and supports aircraft engines mainly through its subcompany Volvo Aero Support, both for military and civilian use. In addition, the engine for the JAS 39 Gripen is manufactured by VAC, under license from General Electric.

The number of employees is 1,100 in the defense sector.

6. Akers Krutbruk Protection AB

Akers krutbruk develops and manufactures light armor for combat vehicles. In addition, it manufactures protection gear for soldiers, such as bullet proof vests and helmets.

B. BASIC FACTS

The Swedish Defense Industry is considered to be surprisingly strong and internationally competitive in research, development and production, especially for a country of small size. Also, Sweden claims to have unique "system builder" competence in a number of areas. A description of the basic facts follows:

1. Capital Turnover

The total value of materiel supplied by the defense industry in 1993 was approximately two billion U.S. Dollars (USD) of which 70% was for equipment to the Swedish Armed Forces.²

2. Exports

Thirty to forty percent of items produced are exported. The Swedish legislation regarding arms exports are very strict, limiting exports. The potential for export is most likely higher.

3. Manpower

The total number employed amounts to 24,000. The number of employees with higher technical qualifications is approximately 18% of the total. In recent years, the Swedish defense industry, including subcontractors, has fully employed some 40,000 persons, about 10% of all those employed in engineering.³

4. Market Share

The domestic industry is normally awarded approximately 70% of the Swedish Armed Forces contracts. Of the remainder, 45% goes to the U.S. and 55% to European firms.

5. Competition

Most of the defense industries have monopoly in their "field". Sweden can not afford domestic competition any longer. There are only a few areas, such as electronics and vehicles, where domestic competition still exists. It is only in those areas where Sweden has a successful and competitive civilian industry, and where the defense portion of the industry is small, that this domestic competition is possible. So, in order to get competitive bids for defense contracts, foreign alternatives are encouraged. Recent examples are main battle tanks and attack helicopters. In cases where a foreign supplier is preferred, extensive trials are held in the country before a decision is made.

6. Capabilities

The industry has development and production capacity in most areas. The exceptions are large transport aircraft, helicopters, military space systems and air-to-air missiles.

C. FOREIGN DEPENDENCE

The defense industry has foreign dependence, both in components and subsystems. The degree of dependence is not determined, but 30% is probably a good approximation. There has been no attempt to clarify all dependencies in detail, but the trend is toward an increasing number of foreign subcontractors and suppliers.

D. INTERNATIONAL COOPERATION

The Armed Forces have encouraged the defense industry to reduce costs for new systems through international cooperation. Current cooperation agreements involving foreign defense industries are found in the areas of:

- Intelligent Ammunition
- Missile Systems
- Submarines
- Advanced Fighter Aircraft
- ECM Systems
- Mine Systems
- Artillery Locating Radar
- Aircraft Engines
- Combat Vehicles⁴

E. FACTS ABOUT MILITARY R&D IN SWEDEN

Total spending is approximately 600 million USD. The funding goes mainly to the Defense Research Administration (FOA), the Defense Materiel Administration (FMV), the defense industry and universities. One third can be considered as basic research, and two thirds as system development.

The Air Force dominates R&D, accounting for 70% of the total budget. This is mainly due to the ongoing JAS multi-role fighter project. (JAS is a Swedish acronym designating fighter, attack, and reconnaissance roles.) It includes not only the airframe, but also development of sensors, communication equipment, electronic warfare equipment and other components.

Spending from the government accounts for 70% of the total R&D budget, and 30% is internal financing by the industry itself. The trend today is that the R&D part of the

defense budget is increasing. This is partly because R&D costs are rising, but also that systems get more and more technology intensive. The most obvious example is electronics, where R&D spending has increased more than 100% since 1985.⁵

There are clear signs that more R&D is conducted in cooperation between different industries. To remain competitive, firms specialize in one specific area or subcomponent, then seek partnership with other firms to build whole systems.

REFERENCES

1. Provided by the Defense Material Administration
2. Association of Swedish Defence Industries, The Swedish Defence Industry, 1994, p. 7
3. Association of Swedish Defence Industries, The Swedish Defence Industry, 1994, p. 7
4. Association of Swedish Defence Industries, The Swedish Defence Industry, 1994, p. 17
5. Provided by the Defense Material Administration

IV. ARMS PRODUCTION AND TRADE - GENERAL TRENDS

This chapter will present the prevailing trends in the arms market today, and discuss some of the implications the trends mentioned may have for the defense industry in general, and for the development and production of weapons systems.

A. BACKGROUND

One of the most significant effects the fall of the Soviet Union and the break-up of the Warsaw Pact has had is reduced defense spending world wide. With few exceptions, most countries have reconsidered the costs for their defense, and have taken the end of the cold war as an excuse for substantial cuts in defense spending. Tensions between countries in different parts of the world have also led to some governments restricting or banning arms export to countries in that region. This has resulted in lower demand for the defense industries' products, both by smaller defense budgets domestically and reduced export possibilities.

At the same time, the cost for R&D and manufacturing of weapons systems has increased significantly during the last decade. It is especially the fixed costs and the R&D share that have increased. An American study has shown increases in real terms between 6 and 13 % per year. The cost may increase as much as 200 to 400 % for every new generation of weapons.¹

Since development cost is such a big part of the total cost, it is important for the defense industry to have long production runs. A company or country that can produce long series gets the benefit of lower development costs per unit and will as a result be able to offer lower prices.

Earlier, increased defense budgets have been able to somewhat offset the rising costs. Since the late 1980s, this has not been the case. This, plus the shrinking market, has made the problems related to economies of scale more and more accentuated. A reinforcing loop can describe this process: lower budgets, less demand, fewer produced, higher cost per unit, less demand, fewer produced.

What is mentioned so far is related to economics, but there are also political problems. One example that has been visible is the lack of political and operational coordination inside NATO. There have been attempts to restructure the acquisition of new materiel, in order to be able to develop and produce systems jointly, but the main part is still developed and produced by the separate countries. This has led to a big number of different systems and standards, which in part makes joint operations more difficult.

B. EXCESS CAPACITY

One obvious result of both lower defense budgets and more expensive systems is fewer orders. This is especially true for more complex systems as combat aircraft, missiles, naval vessels, tanks etc. Ordered numbers are declining, production rates are lower and the time between new systems is increasing. Another trend having negative impact on the defense industry output is that more emphasis is put into modification of older existing systems, increasing their life and capability as a means to save money.²

This leads to more and more defense industries with excess capacity. In the absence of any offsetting action, a reduction in capacity is inevitable. A study presented in 1992 estimated that approximately one fifth of worldwide defense related employment, three to four million jobs, could be lost by end of the 1990s. This study also shows that the export of major weapon systems fell by more than 50 % between 1987 and 1992, and is likely to continue to drop.³

This collapse in international arms trade is primarily due to the ending of the cold war and a resolution of several Third World conflicts. Also, the traditional arms exporters - the United States, Europe, and the former Soviet Union - must contend with an increasingly competitive global arms market, as new suppliers, particularly in the developing world , have emerged.⁴

C. GLOBALIZATION

In nearly every country, arms production has traditionally been one of the most protected sectors of the national economy. Most countries prefer to be self-reliant in arms procurement and domestic defense industries have generally been perceived as the most secure source for defense equipment. Even in the “capitalistic” countries, weapons production was usually placed outside the bounds of free market economics. Competition, efficiency and profitability were secondary to guaranteeing the domestic resources needed for national defense.⁵

In most cases, the defense industry has been dependent on these special conditions. The stable domestic market, supporting the development of new weapons systems both financially and technically, has been important. This is especially true for Sweden, where very strict rules regarding arms export have limited the potential number of export customers.

Today a different trend is emerging. The defense industry is becoming less and less domestic. This trend is often described with the term “globalization”. The term globalization is used as an umbrella for a lot of different activities. Some of the different activities falling into this category are:

- Codevelopment: Transnational design, development, and (production) of weapons systems.

- Consortium: A formal but ad hoc industrial agreement to codevelop or coproduce.
- Family of weapons: An international division of labor involving several related weapons systems, where participating countries separately develop a particular weapon within the group and then permit the other participants to produce that weapon for themselves.
- Joint Venture: An international company jointly owned and operated by defense firms in two or more countries in order to codevelop or coproduce a weapon system.⁶

Globalization implies that development and production of weapon systems is made, at least in part, outside a country's border, and in most cases in cooperation with other nations. This is a big change, and it seems obvious that this trend is going to have implications for a variety of national security issues, including security- and defense policy, arms control, regional security cooperation, and the future size, structure and capabilities of the domestic defense industrial base.⁷

The reasons for globalization can be both military, political and as mentioned above, economical. The most commonly described are some of the following:

- Sharing costs and by doing so reducing the risk of researching, developing, and manufacturing new weapon systems.
- Gaining access to foreign technologies.
- Helping to achieve economies of scale in the production of increasingly expensive weapon systems.
- Developing and penetrating foreign markets that might otherwise be closed to arms imports.
- Enhancing the combat efficiency and effectiveness of military alliances by eliminating wasteful duplication in arms production while promoting battlefield rationalization, standardization, and interoperability.

- Fostering other types of international cooperation, such as NATO political solidarity or European economic integration.⁸

D. RESTRUCTURING

All defense industries face major challenges over the rest of this decade, which will most certainly cause a need for restructuring. A move towards nonmilitary production is one option. Consolidation, concentration in core competencies and downsizing are other options available. These options can be used alone or together.

Another trend that has been especially visible in Europe is the creation of almost monopoly suppliers through mergers and acquisitions. This can either be done to reduce the number of competitors, control important resources (a skilled workforce, technical competence, access to markets, capital and raw material, etc.) or take over customers. There are many examples where big British, French, German and American defense industries have bought other producers of defense systems in both Europe and the U.S. The total number of industries is reduced, and the power is becoming more concentrated to a few companies, often called National Champions. Some companies have decided to leave the defense market totally. Philips, for example, sold all defense related companies a couple of years ago.⁹

Strategic alliances, a loose industrial arrangement between defense industries in two or more countries, is also something that has emerged.

E. NEW COMPETITION

The countries in the Pacific Rim (China, Taiwan, South Korea, Indonesia, Thailand, Singapore and Malaysia) currently constitute the only vibrant arms market in the world. But these countries are different from other former customers in the developing world. Their arms purchases are often accompanied by offset agreements involving technology transfer

from supplier to recipient, and by direct government investment in military research, development and production.

Many of them are now producers of at least some military equipment, and they have also invested in the establishment of modern production facilities. As a result, these countries are becoming more and more self-sufficient in the production of weapon systems and, in some cases, beginning to enter the arms market as exporters.

If this trend continues for another couple of years, some of these countries will be able not only to develop and produce weapon systems with substantial indigenous design, but also pose a serious threat to the established countries on the global arms market.¹⁰

F. OTHER MEASURES

There are two other trends that also must be commented on. The first is that the increased competition forces the defense industries (or in some cases governments) to adopt new pricing policies, in order to get orders for their systems. Here is a recent example from Defense News:

Pentagon officials seeking a competitive edge for U.S. weaponry sold abroad are exercising a loophole in U.S. law that requires research and development surcharges on military items sold through the government's foreign military sales (FMS) program. U.S. government and industry sources said the Pentagon's sale to Sweden of 100 AIM-120 Advanced Medium Range Air-to-Air Missiles (AMRAAM) marks the first use of a new export formula, where the missiles are sold via direct commercial contract administered by the U.S. Air Force. Because the AMRAAM sale is not technically part of the government's foreign military sales program, the contract to be signed later this year between the Swedish Air Force and U.S. missile makers Hughes Missile Systems Co. and Raytheon Co., will exclude surcharges estimated at 114 000 USD per copy, or more than 25 percent of the missile's unit cost, government and industry sources said.¹¹

Finding a way to lower prices is probably a necessity that the U.S. defense industry is forced into by the tough competition its industry is facing in the world market. Removal of the surcharge makes AMRAAM cost-competitive with its French rival MICA, which was the other competitor for the Swedish order. These two missiles will probably be the main competitors for most of the countries that now are in the market for new air-to-air missiles. By removing the surcharge for R&D, the U.S. alternative becomes much more competitive.

The other trend is to reevaluate and relax current export restrictions regarding arms and defense related technologies. This is not something the defense industry itself can do, but it can put political pressure on the government in order to gain access to a closed market. The government may feel a such strong pressure, and see relaxed regulations as a quick and simple solution to some of the industries' problems, so they are ready to reevaluate earlier limitations.

But it is important to remember that new export policies will have to balance the defense industries' economic concern against the countries' foreign policy goals such as arms control and nonproliferation. In this regard, some countries may find it necessary to keep the export restrictions on certain types of weapons and military technologies, and at the same time, remove other restrictions that damage the domestic defense industry.

G. OFFSET

Defense related offset, or "compensation" in the form of license production, domestic production or guaranteed import of goods from the recipient country, is almost a rule in today's marketplace. The reasons for offset are both economical and political.

One important factor behind a request for offset is the political process. In many democratic countries, there is often a debate between different factions before a decision is made. In order to gain support for a decision to buy a weapon system abroad, the government wants to point out other benefits from the deal. Such benefits can be to license produce

domestically (creating jobs), subcontract portions to the domestic industry, or other goals related to industrial policy.¹²

A buyer, primarily in the developed countries, normally has one or more of the following goals when demanding offset:

- Build domestic capital
- Restructuring the industrial base
- Subsidize a region or an industry
- Support its security policy
- Gain political support for the deal¹³

Offset is often tied to one single project, but can be spread out over several years. Offset activities can be both related or unrelated to the imported system. These activities influence the defense industry in different ways:

A percentage of the total ennobled value of the project should be produced in the recipient country. This often make parts of the defense industry in the recipient country subcontractors to the seller and can lead to abandonment of some of the normal subcontractors in the seller country.

The seller may have to transfer technology, knowledge or capital to the recipient country. This usually involves the defense industry in the recipient country, but not always. The transfer can also be unrelated to the imported system. As a rule, many countries want to gain the knowledge and technology to support the system themselves.

The seller country may promise to buy products from the recipient country for a percentage of the system value. This can in some cases be considered as a "payment", and be totally unrelated to the imported system. The defense industry will not be affected by this.¹⁴

As a rule of thumb, offset is almost a must in today's marketplace. And it is up to the recipient to decide what for, and where to use it.

H. SWEDISH EXAMPLES

This chapter has presented some of the prevailing trends in the arms market right now. Even Sweden has adopted some of the measures as the following examples will show.

One Defense News example showing international cooperation is that the Gripen, a lightweight, multi-role combat aircraft developed for the Swedish Air Force, will be marketed worldwide by British Aerospace Ltd. British Aerospace and SAAB Military Aircraft will establish a small joint venture company to market the Gripen, and will undertake whatever work is required to adapt the basic Swedish Air Force design to the requirements of export customers.¹⁵

Under the agreement, British Aerospace will also produce a percentage of the exported airframes, although the two companies have not yet decided where final assembly of export aircraft would be carried out. SAAB hopes that this agreement will lead to increased chances for export by benefiting from British Aerospace's world-wide marketing organization and expertise.

One offset example is the Australian buy of Swedish submarines in 1987. (The Collins class). Kockums created a joint venture together with Australian companies and promised to produce the main parts of the submarines in Australia. They also promised to develop closer links between Swedish and Australian companies in the technology sector.

Another more recent Defense News example, "The Swedish government ... and SAAB Aircraft AB are offering Hungary a 1 billion USD financial and industrial offset package to help Budapest acquire up to 60 of the company's JAS 39 Gripen light combat

aircraft..."¹⁶ This example shows that defense industries, supported by governments, are prepared to go a long way to accommodate a potential customer's offset requirements.

REFERENCES

1. Gunnarsson, Pierre, Forsvarsindustriellt samarbete i Västeuropa: organisationer och drivkrafter, Forsvarets forskningsanstalt, 1990, p. 83
2. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense Budget Project, 1993, p. 1
3. Wulf, Herbert, "Arms Industry Limited: The Turning-Point in the 1990's", Arms Industry Limited (Oxford: Oxford University Press, 1992), p. 18
4. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense budget project, 1993, p. 2
5. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense budget project, 1993, p. 1
6. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense budget project, 1993, p. 6
7. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense budget project, 1993, p. 1
8. Bitzinger, Richard A., The globalization of arms production: defense markets in transition, Defense budget project, 1993, p. 5
9. Sandstrom, Madelene, Wilen, Christina, Ahlstrom, Magnus, Forsvarsindustri i forandring, Forsvarets forskningsanstalt, 1991, p. 16
10. Klare, Michael T., "The Next Great Arms Race", Foreign Affairs, Volume 72 No. 3, p. 148
11. Opall Barbara, Penatagon Uses Loophole To Gain Edge in Foreign Sales, Defence News, Aug 29, 1994, p. 22
12. Sandstrom, Madelene, Wilen, Christina, Ahlstrom, Magnus, Forsvarsindustri i forandring, Forsvarets forskningsanstalt, 1991, p. 38-39
13. Sandstrom, Madelene, Wilen, Christina, Ahlstrom, Magnus, Forsvarsindustri i forandring, Forsvarets forskningsanstalt, 1991, p. 39
14. Sandstrom, Madelene, Wilen, Christina, Ahlstrom, Magnus, Forsvarsindustri i forandring, Forsvarets forskningsanstalt, 1991, p. 40-41
15. Tigner Brook, Swedes offer Hungary \$ 1 Billion Aid to help buy Gripen, Defence News, June 19, 1995, p. 36
16. Briganti Giovanni de, British Aerospace, Saab To Fly Gripen Into World Market, Defence News, Sep 18, 1995, p. 20

V. GOVERNMENT AND ARMED FORCES POLICY

The previous chapters established a background for what the Swedish Defense Industry looks like today and the world market developments in this area. Now the specific Swedish environment will be examined.

This chapter will initially give an overview of the Swedish Armed Forces and the Swedish government's present defense policy. Following this, the Armed Forces' views regarding the Swedish Defense Industry and its importance to the Armed Forces will be examined. The important issue of foreign dependence will also be addressed. Finally, the policy proposed by the multi-partisan government defense committee will be presented in the context of the new geopolitical environment.

These factors and policies together constitute the domestic environment for the Swedish Armed Forces. To a large extent, due to the importance of the domestic market, the future of the Armed Forces sets the basis for the Swedish Defense Industry. (For the international environment - refer to Chapter IV)

A. THE SWEDISH ARMED FORCES TODAY

The budget for the Swedish Armed Forces has been relatively constant (in relative prices) for the last 25 years but has declined as a percentage of GDP (See Figure 2). Since the wartime organization for most of that time remained large (800, 000 men), while the cost of new systems increased, Sweden found itself in the late 1980s with a partly outdated organization formed to withstand a large-scale invasion. This development reflected investments in quantity rather than in quality. In the 1992 defense decision, the center-right coalition increased the defense budget slightly and encouraged the Armed Forces to move towards higher quality and less quantity. This decision gave military leaders more discretion.

Subsequently, they have invested heavily in new equipment. A reduced war time organization was adopted in an attempt to bring balance between tasks and resources.

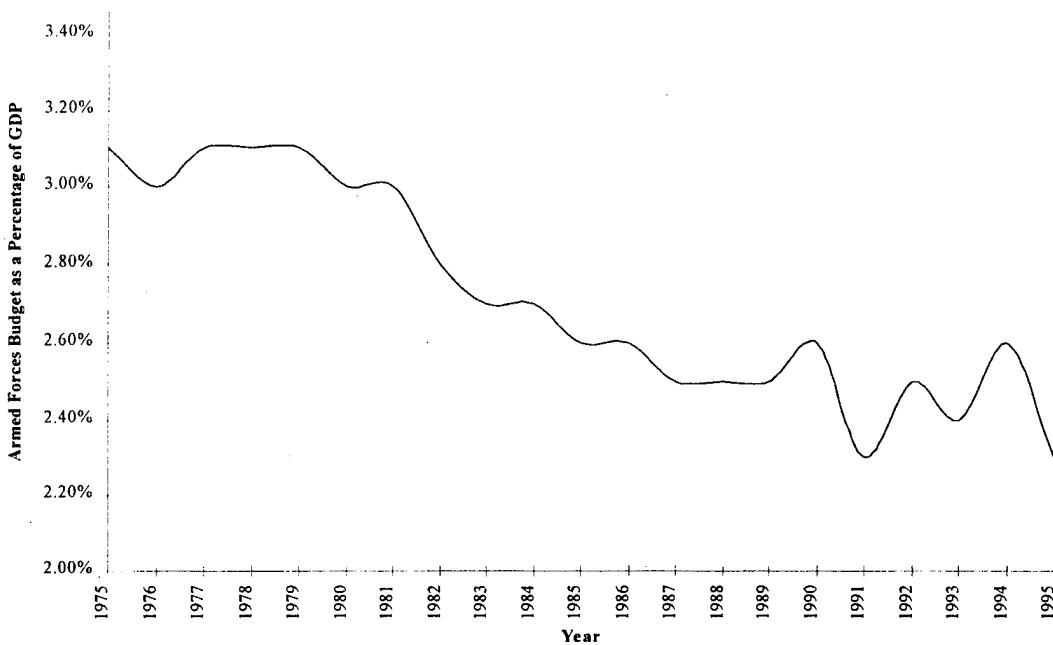


Figure 2. The Budget for the Swedish Armed Forces.¹

B. PRESENT DEFENSE POLICY

Since the Social Democratic party was returned to power in 1994, they have used the new strategic situation as a lever to further downsize the Armed Forces. The government immediately ordered the Defense department to cut its SEK 40 billion budget by SEK 4 billion over five years.² Since then, the party has advocated the following defense agenda:

- Accomplish further and earlier reductions in defense spending. A new defense decision (organization and budget) in 1996 instead of, as planned, in 1997.
- Remain non-aligned/neutral. Membership in either NATO or any other defense pact is not considered an option at this time.

- Maintain flexibility. Reduce the Armed Forces as a response to the current situation, but maintain ability for growth if necessary.
- “Consolidate” in Scandinavia. If possible, a coordination of the acquisition programs between the Scandinavian countries should be sought. The government hopes that shared costs and longer production runs can help sustain some of the capabilities that otherwise would not survive. An agreement among Sweden, Denmark, Norway and Finland was signed in 1994. The purpose is to ensure cooperation in the areas of studies, research, development, production, maintenance and system acquisition.
- Rely on more foreign cooperation. In line with all other high technology branches of the industry, the defense industry must increase its cooperation with foreign companies. Many new projects are so demanding, both technically and financially, that they tend to go beyond the resources of a single company or even a single nation.
- Maintain a basic stand-alone capability in both R&D and production capacity in vital areas.
- Concentrate efforts to recognize and sustain vital niches of defense technology.
- Place more emphasis on civilian industry as a base for defense products. The idea is to improve the capability for rapid mobilization and obtain the lower costs derived from less rigorous specification and testing requirements.
- Seek more dual use products and encourage defense conversions.

The agenda has much in common with the former government agenda. Many of the proposed action items on the previous government agenda have been carried over. The primary differences are a smaller budget, further downsizing, and a consequent emphasis on the ability to “reconstitute” forces when necessary.

C. GOVERNMENT POLICY REGARDING THE DEFENSE INDUSTRY

Despite the constant defense budget in the 1970s and 1980s, the spending level was large enough to sustain a broad based domestic defense industry. Some large export orders during the world-wide military buildup during the 1980s helped postpone the inevitable restructuring. The restructuring has now started and the following excerpts from official documents (translated from Swedish) show the government's policy regarding the defense industry:

The government suggests that the areas of domestic competence, with the highest importance for the defense forces, should be classified as basic competence requirements, defined as those areas in which domestic defense capability is extremely important. This basic competence can be located in the industry, inside defense agencies or in universities. In addition to this deeper basic competence, there is also a need for a broader knowledge base in the defense agencies, in order to be a knowledgeable customer. Basic competence ought to be maintained in the following areas:

- Electronic Warfare Technology Including Sensors
- Advanced Stealth Technology
- Underwater Technology
- Aircraft Technology
- Support and Maintenance

The government will conduct further studies regarding the requirement for munitions production capacity.

It is essential that efforts in these areas are made for the long term and be cost effective. To obtain those goals, the defense forces should place orders for research, development and production of systems with the domestic industry. The armed forces ought to conduct its planning in such a way that the above mentioned competencies can be maintained.

Regarding the other areas of competence, the government states the following:

Other competence can also be vital for the defense forces. But acquisition shall always be made with international competition. Performance, quality, life cycle cost, and proposed offset should be the basis for the final decision. International cooperation and export make it possible to maintain a broader industrial base.

The document anticipates that :

Sweden's membership in the European Union (since January 1995) may lead to a new relationship between defense industries, and... more cost effective system acquisition, for example through joint projects. In order to maintain the industry, Sweden will probably need to participate in the evolving cooperation between defense industries in Europe, in which Western European Armaments Group (WEAG) is an important forum.³

D. THE ARMED FORCES' POLICY REGARDING THE DEFENSE INDUSTRY

From a strictly military point of view, the strength of the Armed Forces is **more** dependent on the types of weapon systems they possess and their capabilities than **where** they come from. From a political point of view, it is regarded equally important to be independent of other countries for defense equipment. Dependence could undermine the capability of the government to maintain a credible neutral, non-aligned stance.

In the preparations for every defense resolution, the Supreme Commander proposes his defense plan for the next five years. In the plan for the period 1992 to 1997, **the** following guidelines were proposed regarding domestic industrial capabilities. It states **that** Sweden must be able to:

- Use and maintain existing systems without foreign support.

- Maintain independent capability in areas that other countries regulate or protect.
- Ensure deliveries and timely mobilization in times of blockade, crisis or war.
- Stay at the forefront of technology and remain an interesting partner in international cooperation projects, thereby gaining access to technology which would otherwise be unavailable.⁴

In a downsizing situation, these are the industry capabilities the Armed Forces would try to maintain as long as possible. As can be seen, they do not differ from the government's view.

E. THE ARMED FORCES' TECHNOLOGY STRATEGY

The Supreme Commander has also initiated work regarding a strategy for classification and prioritizing of key defense technologies. This work is not yet complete, but a 1994 draft offers a prioritized classification of the technologies or capabilities to retain in the defense industrial base:

- A. Technologies with strategic importance for the Swedish Armed Forces which are unobtainable through cooperation with domestic or foreign civilian industry.
- B. Defense technologies closely linked with other technologies that offer highly leveraged opportunities in R&D, production or easy modification of systems. Especially interesting are technologies that can give higher performance, lower cost or higher quality.
- C. Niche technologies in which Sweden has world class capability and is attractive to others for international cooperation.
- D. So-called "promising technology" that can give new opportunities in a longer perspective.

- E. Technologies that can improve the work processes inside the defense industry or the defense forces; for example, system technology, production technology or simulation and modeling.⁵

These priorities are in line with the policies presented earlier.

F. FOREIGN DEPENDENCE

As seen in the previous, foreign dependence is something Sweden and the Armed Forces have to live with and accept. Both in the cases of international cooperation and concentration in niche areas, there will be more foreign dependence. In the first case, this is due to the linkage with foreign firms. In the second case, more products have to be bought from foreign suppliers. Thus, it is necessary to look at the current Swedish policy regarding foreign dependence.

1. Background to Foreign Dependence

It is not economically possible for a country with less than nine million people and a 6 billion USD defense budget to produce all necessary components domestically. The Swedish defense industry is already, like most civilian industries, dependent on foreign industries. The import of knowledge, licenses, components and subsystems is inevitable.

Foreign dependence has therefore been accepted both by the government and the Armed Forces. The dependence can take different forms. Perhaps the most common is that the Swedish defense industry buys components or subsystems abroad and uses them in the development and production of weapon systems in Sweden. Another form of dependence is when the Swedish Armed Forces buys whole systems directly from a foreign supplier. The trend is towards increasing use of foreign produced components and subsystems. An analysis of the reasons for Swedish acceptance of the current level of foreign dependence should include the following elements:

- Domestic demand is not sufficient to support a defense industrial base covering all areas.
- Lower costs: By using components produced in large quantities abroad, costs can be minimized. No domestic research or development is needed.
- By using the world market, the industry will in some cases get access to better technology than what is available domestically.
- An open and competitive market offers significant risk reduction. A case-by-case analysis can identify procurement candidates offering minimum risk.
- Many components are almost commodity items, implying a ready access to substitutes. The wise choice is selective dependency in areas where that is the case.
- Corporate globalization is accepted in Sweden as a fact of the contemporary marketplace. It is hard to tell which country actually “owns” a company, since all big ones are multinational and located in a number of countries.
- The perception is that there will probably be a period of increased tension in the world before a big conflict starts. This “reaction” time can be used to offset the dependency.

2. Risks Involved

The assumptions underlying the official view of the risks of foreign dependence are constantly re-evaluated and debated. An area where the Armed Forces tend to take a more cautious attitude than the government is the possibility of increasing production or procurement from abroad in times of crises. Studies have been conducted by the Armed Forces and the Defense Research Administration, regarding the possibilities to do so. They looked at two scenarios.

First, if slowly increasing tensions allow a period of years before the crisis point, then it is possible to speed up and increase ongoing production of certain systems and acquire systems from abroad. It is also possible to domestically modify and improve existing

systems by changing or upgrading electronics and software. An important determinant of success is the access to imported components and subsystems.

The second scenario allows much less warning before the crisis point. In this case of rapidly increasing tension in the world and a new arms race, there can obviously be problems in acquiring advanced weapon systems, especially for a small neutral country. In situations where access to foreign components becomes restricted, domestic capability to respond to production requirements is uncertain. Due to this uncertainty, the studies suggest that the possibility of increased production should not be considered as a viable option in the overall defense planning or in the prioritization of industrial competencies. An increased use of civilian (dual-use) components may increase the possibility for forced production since availability will be greater.

In either case, a domestic defense industry, with a long tradition of international cooperation in times of peace, is far more likely to retain those mutually beneficial relationships during times of crisis.

3. Reducing the Risks

Until recently, the aim has been to reduce, or at least not increase, the level of foreign dependence. This has been accomplished by increasing the number of suppliers in order to avoid heavy dependence on one or a few companies. Adequate spares have been acquired, and Sweden has always built up the capacity to maintain its weapon systems without foreign technical assistance. Now, steps are taken to form clear policy guidelines that can be used to carefully assess each case and make a decision regarding the risks involved. Clear policy guidelines are needed in this area. A complicating factor is the hidden dependencies inherent in large systems containing sub-components which contain sub-components and so on.

With regard to foreign ownership of Swedish defense industries, current policy requires the government to examine and approve any transaction which may lead to foreign ownership of 50% or more of the company. The government must decide in each case.

Finally, an essential element of any risk reduction plan is to maintain a stand-alone domestic industrial capability in the most critical areas. In those instances of great risk for dependence, or an even greater risk of restricted access to foreign technology, competence has been maintained.

G. EXPORT REGULATIONS

Swedish arms export is prohibited by law. However, the government can give permission on a case by case basis. The law also states that the government decides what is to be considered "equipment for warfare". In simple terms, this means that Swedish industry can not export to a country:

- in armed conflict with another country.
- involved in an international conflict that can lead to an armed conflict.
- that has internal instability.
- that violates human rights.⁶

These strict rules limit the number of countries that the Swedish defense industry is able to export to. And in an effort to make the rules even harder, there is strong pressure from different groups to forbid arms export to all but neutral countries. The following statement from Jane's Defence Weekly 1994 is an example.

Sweden's Minister of Foreign Trade, Mats Hellstrom, has said that the new Social Democrat Government will restrict sales of weapons to the Gulf states. The move follows pressure by peace groups that claimed the Swedish defense industry was trying to expand sales in the area to compensate for the lack of orders at home. Hellstrom told Parliament that the restriction was in response to the "current security situation in the Middle East".⁷

H. COMMITTEE PROPOSAL FOR 1996 DEFENSE DECISION

The parliament and government decide the overall security policy including defense policy. They also set the goals for the defense, as well as the economy. This is normally reviewed every five years when an overall defense decision is made. In preparation for the decision, the government forms a committee consisting of politicians from all parties represented in the parliament. It is important to note that the representatives from the Conservative and the Liberal party did not participate in the work this year, since the instructions from the defense minister prohibited the committee to study alternatives involving participating in the European defense cooperation (WEU) or NATO. This is a unique situation, and it shows how inflammatory this question is in domestic politics.

In order to get the complete picture, it is important to realize there are other factors influencing the government's defense policy. It is not only the new strategic situation that lies behind the proposed cuts in defense spending. It is also the severity of Swedish economic problems. At a time when the welfare state has a huge budget deficit and a fast growing national debt, lower defense spending will meet little resistance in Parliament.

Following are some important statements and conclusions from the 1995 Defense Committee proposal, presented on May 23, 1995 and September 1, 1995. It forms the basis for the parliament decision expected in 1996 (translated from Swedish):

1. Environment

The strategic and geopolitical conditions have changed dramatically in the Baltic Sea area. (See Figure 3) [The breakup of the Soviet Union into smaller states means that..] Russia's contact with the Baltic Sea is now limited to the inner parts of the Gulf of Finland and the Kaliningrad area...⁸

The capacity for an invasion over water no longer exists. Most of the units that earlier constituted the base for this capability are no longer operational or are nonexistent. A rebuilding of the [Russian] capability to accomplish a large coastal invasion in the Baltic Sea area must start from a low level, and

with new geographical conditions. Such a rebuilding would seem to be hard to accomplish in less than ten years. It would also be very hard to do without the world noticing it.⁹

Contrary to the Baltic Sea Area, the strategic and geopolitical situation in the northern part of Scandinavia is basically unchanged. As a result of developments in the nuclear arena , the area's strategic importance might even increase.¹⁰



Figure 3. Scandinavia.

The military component has less importance in the relationship between the East and West, but is still a factor in some regional instances...¹¹

Russia will, during the foreseeable future, still be a society with great resources and many differences from the Western World, for example in economic and social development and political traditions. The adaption/conversion problems that Russia is going through, and accompanying political instability, mean that Russia during the foreseeable future will remain an uncertain factor in Europe and in the Scandinavian region. It should particularly be pointed out that the instability in itself can pose a threat, by a sense of public humiliation and revanchism that may lead to an authoritative regime with an aggressive and unpredictable foreign policy.¹²

2. Swedish Implications

The general security development in Europe has been favorable for Sweden. Armed aggression threatening Sweden appears very unlikely. In addition, the military capabilities to accomplish such operations will for a long time be highly limited. This is especially true regarding coastal invasion.¹³

The demands on the armed forces' capability to meet such aggressions will thus be limited for a number of years to come.¹⁴

If a threatening situation should occur in the near future, it is reasonable to believe that there will be considerable warning. However, it can be hard to draw the correct conclusions from other nations' intentions and preparations. As a consequence, the armed forces must maintain an adaptive capability to be able to meet the threats towards our sovereignty that could rise in the current military strategic situation.¹⁵

Even though we presently have little reason to anticipate a military aggression towards our country ... we must as a non-aligned nation have a reassuring domestic military capability. The Swedish defense must have the ability to subsequently adapt to changes in the international environment. No nation should have a reason to doubt Sweden's will and capability to defend its territory against aggression....¹⁶

The defense policy's credibility and security value is strengthened by close ties to the public. The basis for this relationship is the total defense concept comprising the whole society and a compulsory national service. Thus, a

capability to meet different threats is created, which forms the foundation for the public to defend its freedom and put up resistance in every possible legal way.¹⁷

3. Conclusions

The Swedish “total defense” [concept, effort and organization] is due for reform. Security developments in our part of the world offer new possibilities and pose new demands. The committee proposes a sweeping reform, aiming to create a total defense well adapted to short and long term political developments.¹⁸

Because the threat in the short term is limited, and the development of new threats is considered detectable and time consuming, it is, according to the committee, appropriate to undertake certain reductions by limiting the total defense [smaller and less costly] and to reduce readiness in the short term. However, a definite prerequisite is that a simultaneous and thoroughly planned ability is preserved so that, if necessary, capability can be increased swiftly. Thus, the current organization must have sufficient flexibility to adapt the defense to a future development. The bottom line - the emphasis should be based on a philosophy of adaptability.¹⁹

The Swedish non-aligned policy will continue. Sweden joining NATO and/or WEU would not aid Swedish security policy interests, nor provide stability in our part of the world. Therefore, it is essential for Swedish security that the total defense capability in the long term is on a level that allows a reassuring contribution to the stability in the Scandinavian area, and the capability to face threats to the country....²⁰

I. SUMMARY

The multi-partisan committee proposal for the next defense resolution in 1996 represents a significant cut in defense spending. In addition to the downsizing in 1992, it proposes an additional 25 % reduction of Army Brigades, Navy ships and Air Force squadrons (Figure 4).

The following statement by Supreme commander General Owe Wiktorin to Jane's Defence Weekly 1994, gives some insight into the military view of the proposed cuts. He said that the Swedish defense was already "scaled down to the bones" and that major reductions would not allow the military to defend the country. Gen Wiktorin suggested cuts in the costly obligatory conscript service, but Defense Minister Thage G. Peterson told him to cut elsewhere, saying that Sweden's national service is a democratic institution.²¹

The cuts will most certainly have implications on the defense industry. The ability to provide the armed forces with modern and effective weapon systems is an essential part of the defense policy. The systems can be provided from a number of different sources; in each case a choice must be made whether to buy from the domestic industry, develop the system in cooperation with foreign industry or buy directly from a foreign nation.

Previously, a large portion of the procurement has been made from the Swedish defense industry. The procurement budget has been big enough to sustain a broad and competitive defense industry. However, changes in the world security situation, especially in our region, are having a great impact on the conditions for the future of the Swedish defense industry. A smaller defense force, a smaller defense budget, and more complex and expensive weapon systems, create a completely new environment.

When the time span between orders increases and the number of systems ordered decreases, the costs of maintaining domestic industrial capacity rise. The demand for cost effective system acquisition may lead to lost domestic capacity. In order to reduce this risk, the government and the Armed Forces are trying to develop a long-term strategy aimed at maintaining the most critical capabilities. This situation is not unique for Sweden, as most other countries are facing the same problems. The intention of the Armed Forces is to give clear signals regarding future needs, and by doing so create the conditions for the defense industry to rationally restructure itself.

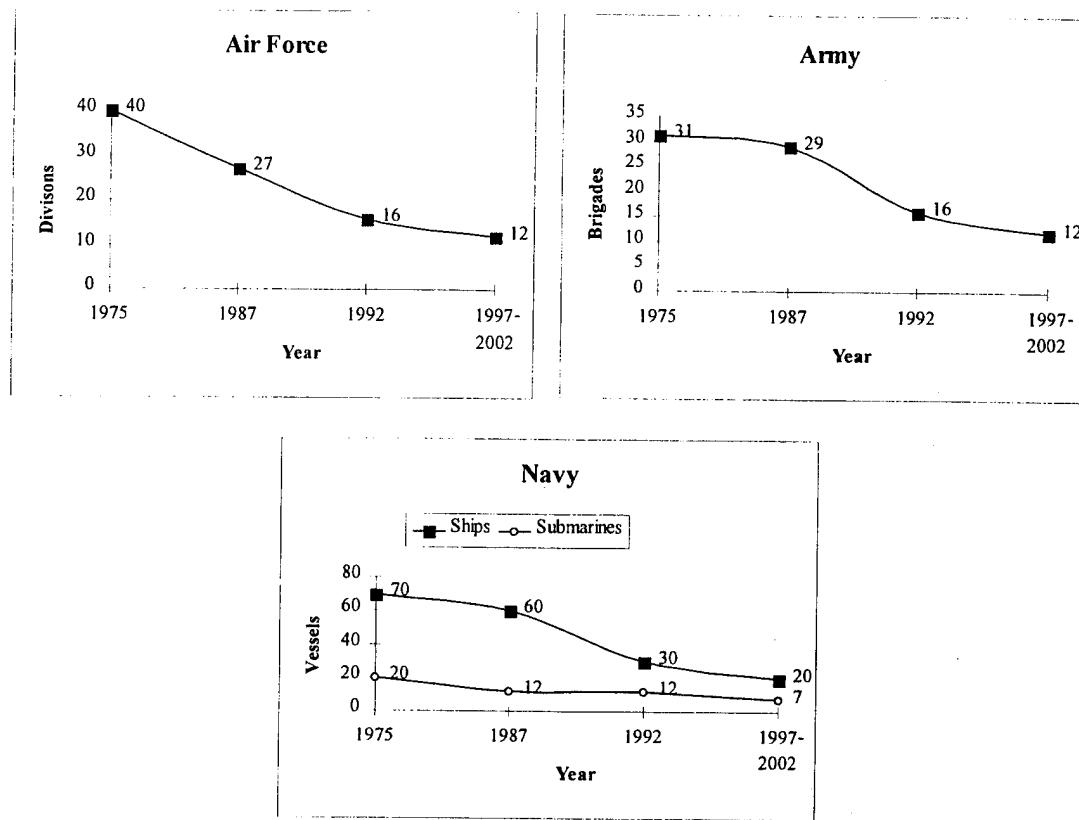


Figure 4. Reduction of the Armed Forces.

Despite these challenges, it is important to note that both the government and the Armed Forces still regard domestic capability as essential. Both have presented what they believe is essential for the future and what domestic capabilities must be maintained. An example of the consensus of government and armed forces with respect to the importance of domestic capability is that, only weeks after the committee presented its proposal, some committee representatives expressed worries. They feared that the cuts would affect acquisition programs too much. In order to bring clarity, the committee decided that the consequences to the domestic defense industry should be investigated, and the results presented to the government before the decision is made in 1996.

In summary, the Swedish Defense Industry faces the following challenges:

- Fewer Swedish defense contracts. The government has stated that there will be at least a 10% budget reduction. Some programs or systems, especially those developed to defend against coastal invasion, face an increased risk of termination.
- Fewer export contracts. The new world order has created an over-capacity in arms production. Although some countries may maintain or even raise their defense expenses, the total market will shrink. Meanwhile new competitors will enter the market.
- Rising R&D costs. Weapon systems will become more and more "high tech"; costs will continue to rise, smaller numbers mean higher per unit costs.
- A restrictive export regulation. Despite the shrinking market, a more liberal and aggressive export policy supported by the government could increase exports. This is not likely; the current (or a stricter) policy will probably stay in place.

REFERENCES

1. Fakta om totalforsvaret 1995, Forsvarsmakten, 1995, p. 33
2. Rapp Johan, Sweden takes its first steps toward finding a few allies, Jane's Defence Weekly, December 31, 1994, p. 39
3. "Totalforsvarets utveckling och fornyelse, rapport från forsvarsberedningen", Forsvarsdepartementet, Ds 1995:51, p. 92-96
4. "Forsvarsmaktsplan 94", Forsvarsmaktens organisationsmyndighet, 1993, p. 39
5. Provided by the Defence Material Administration
6. Maj Ljungfelt, Lennart, Svensk vapenexport i framtiden?, Militärhögskolan, enskild utredning, Dec 16, 1994, p. 14
7. Swedes to cut Gulf sales, Jane's Defence Weekly, Nov 5, 1994, p. 5
8. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 96
9. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 96
10. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 96-97
11. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 119
12. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 120-121
13. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 126
14. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 126
15. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 127

16. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 127
17. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 127
18. "Totalforsvarets utveckling och fornyelse, rapport från forsvarsberedningen", Forsvarsdepartementet, Ds 1995:51, p. 9
19. "Totalforsvarets utveckling och fornyelse, rapport från forsvarsberedningen", Forsvarsdepartementet, Ds 1995:51, p. 11
20. Sverige i Europa och varlden, Forsvarsdepartementet, Ds 1995:28, p. 124
21. Rapp Johan, Sweden takes its first steps toward finding a few allies, Jane's Defence Weekly, December 31, 1994, p. 39

VI. INDUSTRY RESPONSE

In what ways can the Swedish Defense Industry achieve some rational response to the challenges presented earlier? This chapter will look into some available responses and strategies of companies involved in production of military systems. Three different strategies, synthesized from prevailing trends, will be presented and discussed as possible approaches to the new environment. Recent developments will also be presented as well as advantages and disadvantages for each alternative.

These strategies should not be considered as the only possible solutions. Each could vary in detail. Nor must they be implemented separately from each other. But in the discussion and for the comparison purposes in this study, they will be considered as separate.

A. BACKGROUND

As presented earlier, the Swedish Defense Industry must most likely take action to remain competitive. The domestic customer base will no longer be large enough to sustain an industry of current size. This has been a developing process, and is well known by both the government and the Armed Forces. In order to offset the impact of the declining military funding, both the government and the Armed Forces have encouraged initiatives from the defense industry itself on how to deal with the current situation. By delivering clear priorities and a picture of how the largest customer will act, they are trying to simplify the change process.

The strategies used in this research are all industry-initiated. Although some may need government support initially, government interventions or subsidies are not considered in this research. It is the government's view, at least officially, that subsidies directed towards the defense industry are not affordable. If the government wants to intervene there

are other possibilities. The government may, in an attempt to strengthen parts of the industry, direct the Armed Forces to develop and acquire certain weapon systems which the Armed Forces might not have selected if they had the possibility to choose.

As a background for the strategies, it is essential to understand some of the differences between the defense industry and other civilian manufacturers. It should be noted that these differences are not as big today as they were only five years ago. Table 1 summarizes some differences between the two.

| Military | Civilian |
|--------------------------------------|----------------------------------|
| Performance more important than cost | Highly cost sensitive |
| State of the art technology | Off the shelf, keeping costs low |
| Custom design | Standardized, mass production |
| Large, long term contracts | Many customers, many orders |
| Government regulations | Much fewer regulations |

Table 1. Differences Between Military and Civilian Manufacturers.¹

There is another important difference between producers of military equipment and civilian companies. The defense market is regulated and often operating outside of, or without normal market conditions. When defense industries face a shrinking market, and as a result, increased competition, the companies are more limited in their pursuit of more customers. It is almost impossible for the defense industry as a group to influence the demand for weapon systems. Since the companies are very dependent on the domestic market, and have difficulty expanding or creating new markets, the only realistic solution is to take customers away from someone else.

B. ALTERNATIVE STRATEGIES

From the trends presented in Chapter IV, three main strategies can be derived. The approaches presented here have already been used worldwide and also to some degree in Sweden, as some examples will show. The alternative strategies that will be used in this study are:

1. International Cooperation Strategy

This strategy gains access to a larger customer base and more capital through agreements with defense industries in other countries (partners). Shared risks and longer production runs are other benefits. As a result of specialization inside the joint project, R&D and production may in part move abroad, but the Swedish industrial base remains relatively intact. For example: SAAB's agreement with British Aerospace regarding marketing and possible coproduction of the JAS 39 Gripen.

2. Consolidation and Concentration Strategy

This strategy emphasizes consolidation and concentration on a defense market niche, where the industry is, or can become, "world class" in an attempt to gain a competitive advantage over the competitors. The company expands only vertically and specializes on its core business and products. This study is limited to concentration in Sweden and the creation of national champions, consequently R&D and production will remain in Sweden. It gains access to a larger customer base through superior products. The strategy emphasizes cost-cutting measures, and it might also involve the acquisition of international competitors or sub-contractors. For example: Bofors specializes in developing and producing world class portable anti-tank weapons.

3. Integration and/or Conversion Strategy

When utilizing this strategy the company wants to integrate military work with civilian work and/or expand into the civilian sector. New products will be added to increase the customer base and gain capital and knowledge for increased competitiveness in the defense market. This involves an increased use of civilian components and standards. R&D and production will mostly remain in Sweden. For example: Ericsson uses technology and knowledge from their military production when developing civilian communication systems.

In the following each strategy will be presented and discussed in order to form a basis for the evaluation. Swedish examples will also be included

C. STRATEGY I: INTERNATIONAL COOPERATION

International cooperation is an important part of the globalization of the defense industry described in Chapter IV. It is an answer to the increased customer demand for more performance and complexity, leading to increased specialization, which at least for some companies requires an increased degree of cooperation. Cooperation with foreign industries may include all of the following areas: research, development, production, marketing, support, and subcontracting.

One common form of international cooperation is codevelopment, in which companies jointly develop and produce a weapon system. For maximum benefits, it is desirable if this also includes cooperation between the different armed forces from the very beginning, when the requirements and specifications are decided. Cooperation normally also involves cost and benefit sharing over the whole life cycle of the system. Shared risks, costs and economies of scale are some of the benefits from codevelopment.²

One problem involved is that it can be difficult for countries with different geography and force structure to agree on the same specifications. Such agreement often is a necessity

for obtaining maximum benefits. If the weapon system has to be developed and produced in different versions, most of the benefits from cooperation will not materialize. There is also a risk that parts of the research and development, as well as production, may move abroad due to specialization inside the joint company, thus limiting the benefits for the Swedish industry.

Until the early 1980s, most of the codevelopment or coproduction agreements were based on government to government agreement.³ Normally, the governments also decided the work share for each country. This is not easy. It can lead to political disputes over each country's share. One example of this type of agreement is the five nation coproduction of the F-16 fighter.

Today, industry to industry defense collaboration is dominant, while the government initiated cooperation has stagnated. Where the latter exists, it is often a result of offset agreements. The first examples of industry cooperation are joint venture companies, a subsidiary jointly owned and operated by two or more defense firms. Well known European examples are Eurocopter (Aerospatiale/DASA) and Euromissile (Aerospatiale/DASA).

1. Swedish Examples

Some of the benefits and problems involved with international cooperation for a Swedish defense company were described by Celsius president Olof Lund in Jane's Defence Weekly, October 3, 1993. Close European defense cooperation is a top priority for Lund as a way of sharing R&D costs and expanding markets, but cross-ownership and cross-border mergers are unnecessary in Lund's view.

Cross-border mergers are not so easy. It is much better to have very close cooperation, to be real partners and jointly develop a new product with special organizations for marketing to other countries, and not to have very complicated cross-ownerships.

Our philosophy is that Celsius Industries is a public company and the component companies are 100 per cent owned by Celsius. This means we are

free to have joint ventures or cooperative agreements with any company. If we had a French, German or British company holding a part of Bofors, for example, we would probably be blocked if we wanted to have a cooperation with another company.⁴

A number of international cooperation agreements and joint ventures are already established between Celsius and foreign firms. France's Giat Industries and Bofors will jointly develop the BONUS sensor-fuzed artillery round; CelsiusTech has a 50 per cent stake in a joint venture company, Singapore Engineering Software; and Kockums holds a 49 per cent interest in Australian Submarine Corp for the joint development and production of the new submarine for the Australian Navy.⁵

The creation of joint venture companies is a solution also utilized by Swedish defense industry domestically. The production of a new family of armored vehicles (CV 90) is made by HB Utveckling AB, which is owned by Hagglunds Vehicle and Bofors. Another Swedish example is the industry group producing the JAS 39 Gripen, IG JAS, which is owned by SAAB, Ericsson, Volvo, Celcius Tech and FFV.⁶

D. STRATEGY II: CONSOLIDATION AND CONCENTRATION

This strategy emphasizes the core competence of the company as well as efficiency, thus creating a more specialized and competitive industry. By concentrating on its core competencies, the specialities that make the company unique, the firm strives to be among the best in the world. In pursuing this strategy, the firm also wants to drive the technology, to be at the forefront, and if possible outperform all competitors as well as discourage potential rivals. The goal is to obtain a strong, undisputed, stand-alone capability in one or a few technological areas in the military field.

One way of achieving this leading position is transnational mergers or acquisitions, where defense industries actually buy or merge with each other in order to control the

market. This is a relatively recent phenomenon. Most of these mergers and acquisitions have taken place since the late 1980s.

An important part of concentration is to focus on gaining market share and to abandon areas where the company is not competitive. Furthermore, it often involves internal consolidation. For big companies, one possible action might be to combine two production lines and close a facility. A more concentrated production arrangement is probably **more** efficient and can produce savings that can be used in more productive areas. Another essential part of the consolidation strategy is an investigation of all forms of cost cutting available to the company. Everything must be considered in the search for more competitive products, in order to deal with increased competition and decreasing defense budgets.⁷

Available cost cutting measures include cutting research and development, selling plants, freezing wages, reducing capital spending, selling or closing divisions, or reducing employee benefits. Layoffs are often unavoidable since labor represents up to fifty percent of production costs in the defense industry. But there is a risk involved. The company might move from a technology driven industry to a cost driven industry in areas where it does **not** want to, and that would counteract the purpose.⁸

Today there is visible evidence pointing towards concentration. Fifty-nine percent of U.S. companies in a 1995 Defense News survey of leading international defense firms responded that they are concentrating on their core business rather than trying to diversify. Forty-three percent of the companies expressed an interest in selling their noncore businesses. This trend puts pressure on smaller defense industries to either sell to a larger competitor, or buy other companies in order to grow.⁹

The movement towards consolidation and concentration into fewer companies with fewer products is not without obstacles. One problem companies will face, especially if **their** core competence deals with producing mostly classified products, is that the domestic market may not be big enough to sustain the company. Another obstacle that has been **visible** especially in the U.S. market, is the rapid rise in the price of defense stocks, which **makes**

acquisitions too expensive for many firms. The main reason for this stock price inflation is that most potential buyers are interested in the same type of industry - the electronics firms.¹⁰

A Defense News survey in 1995 found that 70 % of U.S. defense companies are interested in making acquisitions, but only 43 % are interested in making divestitures of non-core businesses.¹¹

1. European Development

There is an ongoing consolidation debate in Europe regarding the future of its defense industrial base, and also its relations to the U.S. defense industry. Since the Swedish Defense Industry to a large extent is involved in those discussions, some recently presented views regarding European consolidation broadens the Swedish perspective.

According to the international industrial consultant, Mike Price, Europe's defense industry executives need to follow a well defined route map to consolidation if their companies are to achieve world-class cost competitiveness. In a newly published report entitled "Defense Industry Consolidation - A European Perspective", Price outlines current consolidation trends and suggests how business managers should respond to them if they are not already doing so. According to the report, the consolidation should start with product-led consolidation on a national scale to create "National product champions". After this step the route map follows three subsequent phases:

- Customer focused "National champions", (BAE, Celsius, Finmeccanica etc).
- Product focused "European divisional champions", (Combat aircraft, etc).
- Customer focused "European sector champions", (EuroAir, EuroSea etc).

The report also states that cross border mergers are essential and that project-specific alliances that preserve national capabilities are out of date. National consolidation will not be enough - rationalization within Europe is required. Yet consolidation in Europe, along the lines of Lockheed and Martin Marietta, can not apply because of differing national interests,

military and foreign policies, employment and union laws and the like. The benefits that would accrue from this would include lower overhead cost, greater scope for exploiting regional centers of excellence, less competition, being on more equal terms with their U.S. counterparts, and higher financial rewards. The report concludes: "To rationalize defense production capacity in Europe, governments and industry will need to share this longer term vision."¹²

Therein lies the snag, since most countries still put national interest first and try to maintain domestic capability in many areas. This is, as presented in Chapter V, also true for Sweden.

Another analyst, Pete Deighton, with Smith New Court Securities in London, presented similar thoughts July 27, 1995. "European companies are going to become less and less competitive against U.S. companies." He based this statement on the magnitude of the U.S. domestic market and the sheer size of U.S. defense companies as an important advantage, and also that the European companies must serve a market fragmented into a number of countries, inhibiting their ability to benefit from economies of scale. The many and diverse customers within Europe often result in work frequently divided for political reasons rather than for its cost effectiveness.¹³

After these contributions to the debate, what is the current situation in Europe today? In Sweden Celsius controls a large part of the defense industrial base, while in Italy state-controlled Finmeccanica has an even more dominant position (+70%). A similar process is under way in both Britain and Germany, while the process is slow in France. Important factors determining the need for, or the speed of, the process are defense spending, world market developments and government policy.

2. Swedish Examples

Between 1991 and 1993, Celsius acquired almost half of Sweden's defense industry: Bofors, FFV (Telub, FFV Aerotech) and Nobel Tech (now Celsius Tech). This move

followed a major review of the business and a decision to concentrate on high-technology military niche products.¹⁴

Bofors has also restructured. It started after the company's merger with FFV Ordnance in 1990 when nearly 40 % of the workforce was cut. It has also prepositioned Bofors for achieving its strategic aim of being one of Europe's leading weapon systems manufacturers. Moving away from volume production, particularly in ammunition, Bofors is evolving into a niche technology company with core capabilities in missiles, "smart" munitions, anti-armor and air defense weapons and underwater systems. Determined to produce top of the line equipment, at least 15 % of turnover is reinvested in R&D, the aim also being to develop these capabilities to attract joint venture partners.¹⁵

Capturing niche markets by focusing on a number of core technologies is a strategy shared by Celsius defense electronics arm, Celsius Tech, renamed after Celsius acquired Nobel Tech from Nobel Industries. Concentrating on airborne passive countermeasures, the Electronics Division's Sensors and Countermeasures unit has developed a new chaff dispenser range. Key export contracts have been won from the UK to equip RAF Harrier and Tornado aircraft. The U.S. Navy ordered 290 dispensers for its F-14 Tomcat fighter fleet.¹⁶

SAAB has also taken a further step in focusing its defense businesses with the formation of SAAB Defense. Having split SAAB Military Aircraft from its civil airliner business to market the JAS 39 Gripen more effectively, the company has pulled together its defense activities into one unit. SAAB Defense brings together SAAB Military Aircraft, SAAB Missiles, SAAB Instruments and SAAB Training Systems, to form one unit. The focus of the unit is its JAS 39 fighter aircraft, new stand-off missile developments, a new medium range air-to-air missile, defense electronics and optronics and training systems.¹⁷

E. STRATEGY III: INTEGRATION AND/OR CONVERSION

This strategy includes two related approaches, which to different degrees try to maintain competitiveness, and also the ability to resurge in the case of increased threat, by relying more on commercial products, processes and buying practices. Integration tries to use the same technologies, personnel, administrative procedures, research, and production facilities for both military and civilian customers. Conversion is totally or in part moving over to civilian production and broadening the product base. The strategy's goal is to maintain or even increase the industrial base available for military production, but at the same time not be totally dependent on military customers. Other possible benefits include greater economies of scale, lower costs, and higher quality.¹⁸ Three expressions related to the benefits of integration and conversion are:

- Spin-off: The non-defense commercial viability of technologies, components, and products already developed for defense purposes.
- Dual-use: New technologies with both defense and commercial application.
- Spin-on: The defense utility of existing non-defense, commercially viable technology, components and products with emphasis given to technologies that could improve the affordability of military systems.¹⁹

Spin-off has been a factor in the defense debate for a long time. The latter two are more recent entries. One reason for this is that it would have been almost impossible to take some of these approaches only ten years ago. Up until now, defense technology has almost always been more advanced than its civilian equivalent. Today, however, civilian product technology is often more advanced, and production technologies have advanced to the point where integration is not only possible , but also desirable.²⁰

It is important to point out that there will still be a need for certain areas with specific defense-unique technology. But it does not necessarily mean that those products must be considered unique and be produced in an all-military industry. When examining the

materials, components, and subsystems that the products are made up by, there are often commercial counterparts that are less costly, more advanced and capable of satisfying the same environmental conditions.²¹

Increasing the integration between military and civilian industrial technology and production will lower overall defense costs, promote technology transfer, increase available industrial capacity and strengthen the economic dimensions of national security. The reductions in defense spending make civil-military integration all the more important. This is something that the governments now are realizing, and steps are being taken to move away from military specifications when possible and to make integration easier.

There is a perception that defense technologies are unique because of the way the government procures them. Government regulation has, at least to some degree, prevented the industry from integrating military and civilian production. In general there are three main areas of regulation that create barriers to civilian-military integration: accounting requirements and audits, military specifications and standards, and unique contract requirements. To facilitate the move towards integration, the military must encourage this development by using new types of specifications allowing dual use. This might be especially helpful to those industries already having civilian production.²²

For this to be successful may also require the government to make some policy changes. First, it could review laws that tend to isolate the defense industries from the broader civilian base. Second, as previously mentioned, the Armed Forces need to accept commercial and international standards in place of military specifications. Third, a shift towards greater civil-military integration may require changes in the way research and development is carried out. The funding may have to shift from today's military unique R&D, towards research on dual-use technologies.²³

Two examples of areas that illustrate aspects of conversion are the emerging (European) Aerospace program and the need to rebuild former Eastern Europe. Also mass transit, communication, environmental cleanup and mine clearing are areas where military

producers may have some advantages. Developing new technologies and/or new products related to military products can be one possible way to broaden the product base and move closer to the civilian market. For example, new technologies can be used to track attempted smuggling, or illegal import/export of nuclear material. Developing new or improving existing sensors for detecting nuclear, biological and chemical smuggling might also be successful.

Conversion will not be without obstacles. Successful defense conversion will depend on emerging new markets or the expansion of existing markets. Without them, defense-dependent firms must compete with, and their product displace those of, established suppliers. There are potential markets that may be able to make use of the existing defense technology. However, it is not clear if those markets will materialize, or are expanding sufficiently, or can ever be large enough to fully utilize the defense industries' capacity. Since there are already firms established in these markets, growth must be substantial to support new entrants. There is no guarantee for successful conversion.²⁴

A firm trying to enter a new market faces uncertainty regarding customers and requirements. A firm that is used to a one or few customer environment may have difficulty trying to understand new commercial markets, especially if they lack the necessary marketing skills and organization, including distribution networks for dealing with a broader, more dynamic customer base.²⁵

Another factor is the access to capital. The firms with the greatest need to convert are often the weakest financially, so they may encounter problems in the capital market. There are mainly two factors that are against them. They probably have declining defense sales and they are trying to compete in an unfamiliar market. They therefore will not usually command the highest credit rating.²⁶

There are also structural barriers for defense-dependent firms. The most fundamental structural difference is that the defense market has one dominating buyer, in this case the Swedish Armed Forces. Despite exports, the defense industry is mostly dependent on the

domestic market. Also, for any given defense product there is in most cases only one domestic supplier. Finally, the ultimate good being purchased (i.e. national defense) is public good that is difficult to price.²⁷

The defense market is often highly regulated, which leads to imperfect market conditions. For example, prices (and profits) are often determined by negotiation. To ensure a fair and reasonable price, the Defense Materiel Administration (FMV) checks accounting, cost and pricing data. The regulated nature of the market and special military specifications may have led to overhead costs that place defense industries that want to convert at a competitive disadvantage in the commercial market.²⁸

The difficulty of putting a price on national defense has in many cases allowed performance to dominate over price. Consequently, military technology has in some instances reached a level of costly sophistication for which the civilian sector may not be willing to pay. The complexity of military systems has led to a long development process favoring revolutionary, but slow, innovation. The defense industries have gotten used to research, design, development, and production cultures that may not function well in a more cost-conscious and dynamic market environment.²⁹ Recent years' increased competition has put pressure on the industry. Today defense industries are forced to be more competitive.

1. Swedish Examples

This example from Jane's Defence Weekly, October 17, 1994, shows both successful Swedish spin-on and spin-off, and how the military producer uses the civilian part of the company for its business.

By luck or by judgement, telecommunications giant Ericsson has benefitted enormously from its defense arm, Ericsson Radar Electronics (ERE) - something which its President, Bengt Halse, will not let the parent company forget. "Other companies talk about using defence technologies in the commercial market, but we are actually doing it", said Halse.

The company employs less than four percent of its parent's total workforce but provides a significant R&D and technology base. Components and techniques developed for military applications have been successfully applied into the commercial market and then fed back to the military side. The Mini-Link microwave communications system is the prime example. Now established in the commercial market, the company has developed a military version of its Mini Link, the MF-15, using the advantages of commercial development. "A high growth rate is achievable because we have an unbeatable market distribution through our parent company," Halse added.

Dual-use items are proving helpful in reminding the parent of the worth of a high technology defense arm, and ERE is sure they will continue to have support from higher up, even though shrinking defense budgets are forecasted.

A downturn in technology spending would inevitably affect ERE since, although it exports around 50 % of its output, it has traditionally relied heavily on the Swedish government for development work. What may act in the company's favor, however, is the shift away from manpower solutions to technical ones.³⁰

F. SUMMARY

This chapter has presented possible industry-initiated strategies for the Swedish Defense Industry. Examples were used to exemplify the ongoing process. In the next chapter the strategies will be evaluated using the future needs of the Swedish Armed Forces. The strategies are shown in Table 2.

| | |
|-----|---------------------------------|
| I | International Cooperation |
| II | Consolidation and Concentration |
| III | Integration and/or Conversion |

Table 2. Industrial Strategies for the Swedish Defense Industry.

REFERENCES

1. Adapted from IEEE Spectrum, Vol. 26, No. 11, November 1989, p. 4
2. Bitzinger Richard A., The Globalisation of Arms Production, (Defense Budget Project, December, 1993) p. 8
3. Bitzinger Richard A., The Globalisation of Arms Production, (Defense Budget Project, December, 1993) p. 13
4. Reed Carol, A step by step assent, Jane's Defence Weekly, Vol. 20, No.18, October 3, 1993, p. 37
5. Reed Carol, A step by step assent, Jane's Defence Weekly, Vol. 20, No.18, October 3, 1993, p. 37
6. Reed Carol, A step by step assent, Jane's Defence Weekly, Vol. 20, No.18, October 3, 1993, p. 37
7. Finnegan Philip, Trend To Consolidate Increases Specialization, Defense News, Vol. 10, No. 30, July 31, 1995 p. 18
8. Finnegan Philip, Companies Streamline To Stay In Global Game Defense News, Vol. 10, No. 30, July 31, 1995 p. 16
9. Finnegan, Philip Trend To Consolidate Increases Specialization, Defense News, Vol. 10, No. 30, July 31, 1995 p. 18
10. Finnegan Philip, Trend To Consolidate Increases Specialization, Defense News, Vol. 10, No. 30, July 31, 1995 p. 24
11. Finnegan Philip, Trend To Consolidate Increases Specialization, Defense News, Vol. 10, No. 30, July 31, 1995 p. 24
12. Report shows Europe the way to success, Jane's Defence Weekly, July 15 , 1995, p. 39
13. Finnegan Philip, U.S. Defense Giants Pose Dounting Challange, Defense News, Vol. 10, No. 30, July 31, 1995 p. 10
14. Reed Carol, A step by step assent, Jane's Defence Weekly, Vol. 20, No.18 p. 37, October 3, 1993
15. Reed Carol, Celsius: a Swedish success story, Jane's Defence Weekly, Vol. 20, No.18, October 3, 1993, p. 38
16. Reed Carol, Celsius: a Swedish success story, Jane's Defence Weekly, Vol. 20, No.18, October 3, 1993, p. 38
17. Bickers Charles, Saab goes on the offensive, Jane's Defence Weekly, Vol. 21, No.17, April 3, 1994, p. 29
18. Report of the CSIS Steering Committee on Security and Technology, Integrating Commercial and Military Technologies for National Strength, The Center for Strategic & International Studies Washington, D.C., March 1991, p. ix
19. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 6

20. Report of the CSIS Steering Committee on Security and Technology, Integrating Commercial and Military Technologies for National Strength, The Center for Strategic & International Studies Washington, D.C., March 1991, p. ix
21. Report of the CSIS Steering Committee on Security and Technology, Integrating Commercial and Military Technologies for National Strength, The Center for Strategic & International Studies Washington, D.C., March 1991, p. xii
22. U.S Congress, Office of Technology Assessment, Building Future Security, 1992 p. 27
23. U.S Congress, Office of Technology Assessment, Building Future Security, 1992 p. 27
24. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, pp. 10-11
25. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 11
26. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 12
27. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 11
28. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 11
29. Moteff John D., Defense Technology Base Programs and Defense Conversion, Congressional Research Service, April 6, 1995, p. 11
30. Bickers Charles, ERE: relying on radar, Jane's Defence Weekly, Vol. 22, No.13, October 1, 1994, p. 44

VII. EVALUATION

The purpose of this chapter is to compare the alternative defense industry strategies in light of future Swedish military needs. Each strategy will be graded on how well it fulfills those needs. This methodology is suited to evaluate the degree to which each strategy fulfills the needs of Swedish government and Armed Forces. Regardless of the strategy selected, the defense industry will continue to be dependent on the domestic market. Although the methodology will not be able to predict which of the strategies will be most successful in the marketplace, it might provide an indication of the potential for marketplace success.

Evaluation criteria for the comparison will be derived from the requirements of the Swedish defense, government policy, the role of the Armed Forces and the defense industry. To get a broader view, other scenarios which consider possible geopolitical developments will be investigated. The final selection of evaluation criteria will be based on government and Armed Forces priorities.

It is important to point out that an individual company might choose a combination of strategies including strategies not mentioned here. But for the comparison the three strategies will be evaluated separately and not in combination.

A. GOVERNMENT AND ARMED FORCES REQUIREMENTS

From the government and Armed Forces policy presented in Chapter V, the following evaluation criteria can be derived:

- Provide competitive systems for the Swedish Armed Forces
- Support build-up and mobilization capability
- Sustain a broad defense industrial base for later growth
- Provide the Armed Forces with systems and technology unavailable from abroad

- Support and modify systems in inventory
- Limit foreign dependence
- Sustain competitive advantages in selected areas
- Enable stand-alone capacity, where possible, with no need for government support

B. GEOPOLITICAL SCENARIOS

The positive trend of a decreasing external threat upon which the government bases the defense downsizing may not continue. Other scenarios are possible. In an effort to maintain a flexible policy, some of these possible developments have been accounted for in the government and Armed Forces policy. The goal is to be able to adapt defense policy and defense readiness to the new threat, if the security situation changes. To understand the demands these scenarios might impose on Swedish defense, selected scenarios will be described, and relevant evaluation criteria derived. In some cases the evaluation criteria will be accounted for by government and Armed Forces policy.

1. Scenario 1: Move from Neutrality Policy Toward WEU or NATO

As a result of the ongoing changes in Europe, and the fact that Sweden is a member of the European Union since January 1, 1995, Sweden might reconsider its neutrality policy and apply for membership in NATO or WEU. From an official point of view, this is not a likely development. The non-alliance neutrality policy remains very important, since Sweden is a country in which neutrality is widely perceived as having held Swedes out of two world wars. It is only recently that the issue has even been debated. Wilhelm Agrell and other independent security analysts have said that Sweden "has in effect chosen its path" by entering the European Union (EU) and by joining NATO's Partnership for Peace in 1994. "It is a deliberate twist of facts to claim we have a continued policy of neutrality", Agrell said.¹

It is a fact that Sweden joined the EU without reservations about the block's plans for a joint foreign and security policy. Sweden also has applied for observer status in the Western European Union, the EU's embryo to a joint European defense.² If a membership in either WEU or NATO would be a reality, new demands would be put upon the Swedish Defense Industry. The following evaluation criteria can be derived from this scenario:

- Support force integration with the alliance
- Participate in foreign cooperation projects
- Modify existing systems to new standards
- Maintain high competence in selected technologies to make Swedish industry an attractive business partner
- Maintain and support other nations' equipment

2. Scenario 2: New Tension in Former Soviet Union; Increased Risk for Invasion

From a Scandinavian point of view, the "threat spectrum" in Europe has radically changed. It is yet too early to determine if it is going to develop toward stability or uncertainty. The pattern of security and military strategy in Northern Europe is rapidly changing. There is consequently a great amount of uncertainty. One possible outcome is that a more aggressive government comes to power in Russia, and a new "anti-western policy" will dominate. Tensions would rise, and there would be an increased risk of military confrontation. The following evaluation criteria can be derived from this scenario:

- Responsiveness, capability for increased production
- Support rapid build-up and mobilization
- Modification (improvement) of existing systems

- Rapid development of new weapon systems

3. Scenario 3: Non-military Threats

An increasing number of politicians argue that the old way of looking at the outside world cannot be limited to the risk of military attack against Sweden. The expanded concept of "a threat spectrum" must be extended to comprise situations in which in the Swedish Armed Forces could be called upon to play a part in a Scandinavian or European action. Such situations might include new security policy structures and new actors responding to economic conditions, ethnic and religious conflicts, international crime and terrorism, refugees and environmental threats or catastrophes which affect security to a greater extent than before. The following evaluation criteria can be derived from this scenario:

- Capability and flexibility to produce new products
- Ability to convert civilian products
- Ability to convert military products
- Ability to destroy old weapons in an environmentally safe manner
- Capability to develop and produce new non-lethal peace-keeping weapons

C. SELECTION OF EVALUATION CRITERIA

Of all requirements presented, six criteria have been chosen to be used in the comparison (See Table 3). It is important to stress that these criteria are subjectively selected by this researcher, bounded by government guidelines set for the Armed Forces and indirectly for the Swedish Defense Industry, but also taking into consideration reasonable alternative scenarios. The comparisons are not an exhaustive attempt to give the right or best solution. Rather, this comparison should be viewed as a tool for evaluating likely

developments, as one possible approach for assessing the future of the Swedish Defense industry.

| Criteria Number | Evaluation Criteria |
|--------------------|--|
| I | Provide competitive systems for the Swedish Armed Forces |
| II | Support build-up and mobilization |
| III | Sustain a broad defense industrial base for later growth |
| IV | Provide the Armed Forces with systems and technology unavailable from abroad |
| V | Support and modify systems in inventory |
| VI | Limit foreign dependence |

Table 3. Evaluation Criteria

D. EVALUATION

The three strategies will be evaluated using the different evaluation criteria chosen. Three different ratings will be given, +(positive), o(neutral), or -(negative), depending on how well the strategy meets the criteria. Before each comparison of strategies, a short description of the criteria will be made. Table 4 on page 86 summarizes the results.

1. Criteria I: Provide Competitive Systems for the Swedish Armed Forces

a. *Description of Criteria*

For a variety of reasons, most of the equipment used by the Swedish Armed Forces is produced by the Swedish Defense Industry. In almost all areas, there has been a competitive domestic industry able to provide high quality systems at competitive prices. The defense industry has been able to do this since the defense budget has allowed the armed

forces to acquire new systems on a regular basis. Proposed new spending levels will no longer allow this luxury. The Armed Forces cannot continue to acquire new weapon systems at the current rate or over the whole spectrum of requirements for the Army, Navy and Air Force. Limited resources will allow fewer systems to be ordered. Time between major procurements will increase. It will also be necessary for the Armed Forces to prioritize requirements to ensure that high priority areas receive top of the line equipment, while other areas must fall behind.

b. Evaluation of Strategy

(1) International Cooperation Strategy[+]. It is uncertain to what extent this strategy can be utilized by the different firms. However, a reasonable assumption is that a high percentage of Swedish defense manufacturers can, in some way or another, pursue this strategy. In this case, the strategy has a high probability of helping to sustain the continued business operations of Sweden's competitive industries. The main reasons are that cooperation and building connections with industries abroad results in lower costs and access to a larger market. Both factors contribute to increased sales.

Despite this, the size of the domestic industry might decrease if disproportional development or production is moved abroad. Even so, individual Swedish industries can survive as a part of a larger multi-national organization. If a large percentage of the industrial base remains competitive in this new environment, Swedish industry will most probably be able to continue to develop and produce competitive systems for the Swedish Armed Forces, or at least produce Swedish versions of systems jointly developed.

(2) Consolidation and Concentration Strategy [o]. Not all businesses can adopt this strategy. Many smaller and weaker companies will be weeded out. A reasonable prospect for success probably requires both a leading position in the world marketplace and a strong financial position. It is also helpful if the firm already dominates the niche in which it wishes to concentrate. Both technical sophistication and low production costs will be essential for most markets. Of course, most companies will be able to cut costs

in one way or another, but cost-cutting alone will not be enough. As a result, there will probably only be a few industries capable of totally adapting to this strategy successfully.

Except in cases of spectacular success in the international market, these companies will initially remain dependent upon the domestic market. So, in most cases, it will only be possible to be competitive in areas where the Swedish Armed Forces are able to continue to acquire new systems and support R&D. With fewer remaining companies, this strategy cannot maintain an industry capable of developing and producing systems for the Swedish Armed Forces in all requirement areas. The end result will be an increased number of systems acquired abroad, with fewer but top-of-the-line weapons produced in Sweden.

(3) Integration and/or Conversion Strategy [o]. This is an approach open to most companies. The question is how far they can go in integrating civilian and military business structures. The potential will vary from company to company. A first step might involve integrating civilian components and processes into military production in order to become more competitive and increase the chance of winning orders. If the policy is taken further, new civilian products can be produced as a complement to current products or as a replacement for military orders. Not all companies could go this far, especially if the downturn in the military market has affected the financial strength of the company.

If civilian production is successful while the outlook for military orders is slim, the company is probably best off concentrating on the civilian product and liquidating or converting military production. Successful integration requires the civilian part of the company to be not only successful, but also large enough to help the company survive between military orders. An additional consideration would be the firm's capability to support or conduct ongoing military and civilian R&D.

The probable outcome of this strategy is that some companies will successfully adopt civilian processes and components and become more competitive in the military marketplace. Other companies might add civilian products and diversify their

business, which also will make them more flexible, improving the chances for survival. Another possible outcome of more civilian applications in military systems might be that companies producing solely civilian products today could develop the flexibility to compete for military orders as well. Nevertheless, since a number of companies will not be able to successfully adopt this strategy, the strategy will not maintain an industrial base capable of developing and producing competitive systems for the Swedish Armed Forces in all requirement areas.

2. Criteria II: Support Build-up and Mobilization

a. *Description of Criteria*

In order to be able to support build-up in times of "unrest" or mobilization, the industry must be competent and knowledgeable as well as possess the facilities, components and personnel required to support production. The production facilities must also be located so that production and delivery of goods can be controlled or at least influenced by the Swedish government. No interdiction of delivery by military or political means would be acceptable.

Two different types of production can be considered in a build-up or mobilization situation. One is production of relatively simple products (consumables), for example, small arms or artillery ammunition. The other is the production of more complex weapon systems.

The first alternative is less complex and requires less lead time and is therefore more readily attainable, especially if the lead time (warning) is short. Contingency preparation during peace time could facilitate the start-up process and shorten the order-to-delivery time. On the other hand, the latter alternative would require greater lead time for successful implementation, due to the time required to get everything together for the production of a complex product. Unless the system is already in production, this time frame could be two years or more.

Additional factors include the availability of necessary raw materiel, tools, components and subsystems. To overcome this problem, Sweden normally keeps an inventory of materials designated as essential. Another technique is to include stockpile requirements within key procurement contracts.

In an attempt to reduce spending, the Swedish "total defense" concept has been dependent on support from the whole society (such as using peacetime commercial trucks as wartime military transports) and on delaying a selected procurement until hostilities appear to be imminent. The latter is known as prewar production, in which industry and the Armed Forces jointly plan for "surge" production only as the need arises. The government has mandated that certain lines of production, important for national security, must remain in Sweden and be ready to support the country on short notice. This applies not only to the defense industry, but also to many civilian companies.

It is important to realize that the policies needed to achieve the goal of increased production might be in conflict with other necessary policies and therefore require tradeoffs. An industry that has reduced excess capacity to promote efficient peacetime production may have consequently limited its ability to meet surge requirements.³ Relying on surge production of materiel when needed avoids the costs of manufacturing (buying) and stockpiling, but entails investment in excess production capacity and thus lowers the efficiency of the peacetime production base. Stockpiled military materiel has the advantage of being immediately available, but carries manufacturing (buying) and storage costs. It may also become obsolete before it is needed.⁴

b. Evaluation of Strategy

(1) International Cooperation Strategy [+]. This strategy retains most of the competitive Swedish businesses, with at least parts of the industrial base still located in Sweden. Thus, a domestic base for production and technical support remains to support "prewar production" requirement. It is also reasonable to believe that subcontractors will be located in the country and they, as well, would retain the capacity to play an

important role. An important consideration is where the production facilities are located. If they are in Sweden, production can be maintained or even increased, at least as long as the supply of components lasts. But there might be drawbacks. In a situation where most of the production facilities are located abroad, the Swedish share of the company is limited, or the demand for the products is high in other owner countries, Swedish access to production capacity in times of need could conceivably be limited. However, access will inevitably be better among cooperative partners with an established relationship than it would be between a dependent Sweden and a sole-source foreign provider.

(2) Consolidation and Concentration Strategy [o]. The few remaining companies successfully utilizing this strategy will most certainly be able to support a build-up or mobilization, at least in their areas of competence, since the definition of concentration in this context includes production facilities physically located in Sweden. In times of crisis requiring prewar production, some production lines will be able to support build-up and mobilization while maintaining exports. Other lines will only be able to support domestic requirements. However, in areas in which basic capacity has been lost, it will be difficult or even impossible to obtain necessary support.

(3) Integration and/or Conversion Strategy [o]. If the integration has been successful, the company has preserved an expertise and production facility base capable of manufacturing military products. It is likely that in some cases, full-system production competence will be impaired, but an ability to produce parts or sub-systems can still be very valuable. This strategy also gives the industry an increased flexibility. In the areas where the competence is sustained, the ability to support build-up and mobilization is good. For areas in which military production capability is lost, the industry might be flexible enough to support the build-up with (modified) civilian components or products.

3. Criteria III: Sustain a Broad Defense Industrial Base for Later Growth

a. Description of Criteria

The growth concept has been introduced by the government in the debate over the downsizing of the Armed Forces. The government's viewpoint is that the time available from the first signs of unrest to the outbreak of war will provide ample time to increase the strength of the Armed Forces, both through systems acquisition and refresher training.

The Armed Forces, facing the fact of the growth concept, are fighting for a funding level sufficient to maintain all vital areas of the defense industry (the broad base). A preservation of these vital areas is necessary if the concept is to have any prospect of success. The Armed Forces' position is that, in order for the growth strategy to be successful, some basic requirements must be fulfilled. There must be an existing and competent industrial base to grow from, and it must be able to provide sufficient support within the available time frame. The Armed Forces must also be able to acquire and use a limited number of modern systems in all relevant areas, to permit officers to train and develop tactics for their use.

b. Evaluation of Strategy

(1) International Cooperation Strategy [+]. One of the positive outcomes of international cooperation is that it is likely to preserve a relatively broad domestic industrial base. This fits nicely into the requirements for later growth, even if the capacity is not initially sufficient. A possible drawback might be that domestic competence may have decreased in some areas due to specialization inside the new joint company. There is a good chance this strategy will maintain a broad base.

(2) Consolidation and Concentration Strategy [-]. In the case of concentration, with only a few highly competitive companies left, the result will be the opposite from the case with international cooperation. The defense industrial base will only consist of a few surviving industries. Even though the competence level might be high, there

will not be a broad base available to build from. The need for build up in the uncovered areas will remain, but there will be no fast domestic solution available. The competence is lost. As a result, this strategy will not maintain a broad base.

(3) Integration and/or Conversion Strategy [o]. If this strategy is chosen, there is a high probability that, even if not all industries continue to produce military products, some military competence will still remain in the diversified companies (which may be used in the civilian production). For a few firms in which the integration has been successful, the company has preserved both knowledge and production facilities capable of producing both civilian and military products. It is likely this strategy will be able to maintain a relatively broad base, though with varying degree of military competence. The companies may not be as competent as the leading military producers, but it still is a base upon which to build.

4. Criteria IV: Provide the Armed Forces with Systems and Technology Unavailable from Abroad

a. *Description of Criteria*

One of the most important tasks for the Swedish Defense Industry has been to sustain an industry capacity to develop and produce weapon systems which other countries safeguard or impose tight restrictions on. This has often been the case in the areas of sensors, encryption, seekers, communication equipment and the like. This domestic capability has made it possible for the Armed Forces to field systems different from those used by the super powers. Most NATO and Warsaw Pact equipment was developed to target each other's systems. Swedish equipment, on the other hand, has been developed to operate against a broader variety of threats - often using unique technology - and offers clear defensive advantages in this regard.

Up until now, the Swedish industry has been able to provide the Swedish Armed Forces with domestically developed systems in most of these areas. There is a risk

this will no longer be the case. The Armed Forces regards domestic competence in these areas as essential, since the modern battlefield requires top-of-the-line equipment in these high technology areas. Countries forced to rely on foreign systems face not only the risk of getting second rate, degraded export versions, but also the possibility of getting no equipment at all.

b. Evaluation of Strategy

(1) International Cooperation Strategy [o]. There are a wide variety of opinions regarding technology transfer and the need for keeping certain technical expertise classified. One perspective is that industries from each participating country, in order to be “accepted” into a cooperation project, must contribute their core competence, the best they have, even if this earlier was regarded as classified. Another approach might be that some industries or countries will not engage in projects with other countries in areas they consider “sensitive”. For either national security or competitive reasons, they want to withhold technical expertise. This is a complicated question for the Swedish defense industry, since it involves Sweden's special non-alliance situation and the limitations this might pose on the information flow in both directions.

There might be instances where the industry wants to use a certain technology in a cooperation project as a way to gain access to a larger market. Many defense firms face this problem. It is easier to gain access to customers and capital in an alliance, in which more countries use the products.

In cases where the domestic market is large or the company is supported by the government, the company has no need to export unique technology. The government and the Armed Forces might also oppose technology transfer in certain areas, because the military could be forced to change strategy or tactics when formerly secret systems become common knowledge.

Cooperation will keep more companies in business, but it is uncertain whether they will have the capability to specifically provide the Swedish Armed Forces with state of the art technology. Cooperation might render an increased transfer of technology into Swedish industry. At the same time, it will be harder to keep unique competence hidden from the partners, since that would be against the spirit of cooperation. To conclude, at least in some areas, the industry will probably lose the ability to provide the Swedish Armed Forces with unique state of the art technology unavailable from abroad. However, it will create better opportunities for the use of foreign technology. Cooperation provides an affordable but not a unique solution.

(2) Consolidation and Concentration Strategy [+]. The few companies that successfully utilize this strategy will be in a good position to provide state of the art equipment. It might be the only strategy capable of developing the necessary competence inside a single company. One possible drawback is that it may be difficult to utilize this strategy for technologies a country wants to keep for itself. The basic theory behind concentration is to become world class, i.e. better than everybody else. From this leading position the company can increase the customer base and be able to stay ahead of the competition. If, in this case, the government decides that the technology or the products have a national security interest and therefore that the customer base must be limited, then the concentration strategy becomes difficult. One available solution is to use different software for export systems. Another way to build or sustain world class capacity under those circumstances is for the government or the Armed Forces to support continuous research and development in those industries considered vital to the national security. In some cases, this could be the only solution available for Sweden, but the support would likely be quite expensive.

(3) Integration and/or Conversion Strategy [o]. The incredibly fast development in the technology sector, especially electronics, computers and communications, has in many cases lead to a situation in which the civilian technology is ahead of the military. In most of these areas, there is already a movement towards utilizing

the civilian technology in military applications. This strategy not only increases performance and shortens development time, but also lowers costs. This is clearly an area where a competent civilian industry might be able to provide the requested systems.

The Ericsson company is an example of this potential. As presented earlier, Sweden has world class industries in the technology sector. It could be that Ericsson, due to its competence in the civilian sector, may be able to compete for systems for the military, even without having a military "division" maintaining continuous military research and development. This might not be possible in other areas, where for example more mechanical engineering is needed.

Other alternatives must also be explored. Are there civilian applications for products that earlier have been all military? Scramblers for telephones and computers, communication systems, security systems - all have civilian applications, a fact which helps companies maintain dual competence. The companies choosing this strategy will be in a good position to make use of civilian "high tech," even if they do not possess it themselves.

5. Criteria V: Support and Modify Systems in Inventory

a. *Description of Criteria*

This is often stated as an absolute minimum requirement in both government and Armed Forces policy documents. Even in those cases where Sweden has acquired weapon systems abroad, it is considered very important to have the ability to support and maintain the systems without foreign support. The reason is to reduce foreign dependence, thereby ensuring the systems can be maintained in times of unrest or war, when foreign support may be disrupted or withheld.

The Armed Forces have historically been able to rely on a broad competence in the domestic defense industry and some parts of the civilian sector as well. They have

benefitted from the fact that a broad domestic defense industrial base provides an easy capability to maintain and support similar or related systems.

In cases where development or production competence cannot be sustained domestically there might be methods of maintaining enough competence for support and maintenance, perhaps by creating a specialized maintenance and support industry. The capability to rapidly upgrade software would be a specific example which would be applicable across a broad range of applications.

However, there are at least three problems in attempting maintain a maintenance and support capability without an underlying industry base and R&D capability. First, for new technology, there could be a lack of existing related competencies and difficulty in acquiring the new competencies required for dissimilar systems. Second, for old technologies, there could be problems maintaining skill and spare parts, making support and maintenance quite expensive. Finally, since not all systems in the inventory are of Swedish origin (e.g., air-to-air missiles for the Air Force are almost entirely foreign made), there could be restrictions on what the industry is allowed to do with the foreign technology.

b. Evaluation of Strategy

(1) International Cooperation [+]. Although the size of the industry might decrease if parts of development or production move abroad, the company in question will most probably survive as a part of a larger organization. Since at least a part of the industry will survive and remain in Sweden, the ability to support and modify systems should also remain. There could also be advantages in having access to the resources of the larger organization or cooperative partners. Most certainly the Swedish companies involved in joint development, production and maintenance efforts will be able to maintain the expertise required to maintain and modify existing inventory items. Also, with the access to a larger market created by participation in joint efforts, some Swedish companies could concentrate on this specific task for that larger market, further enhancing domestic capabilities and contributing to the Swedish economy.

(2) Consolidation and Concentration Strategy [o]. There is one obvious risk involved with this strategy. Competence and skill can remain very high in some areas, and be lost in others. As a result of this strategy, parts of industry competence will inevitably be lost. The first losses would most likely be in the capacity to develop new systems. Later, the production capacity would be lost. Finally, the industry could in many cases lose even the competence to support existing systems. This would be the case when the company had to close down completely.

One solution could be that one industry concentrates on support and builds competence in this area. It will have no competence in research and development of new systems, but instead a broad competence in support and maintenance. One question is if the Swedish inventory is large enough sustain a viable company. Another question is whether the field of support offers sufficient economies of scale and related functionalities across the broad range of air, land and sea weapon systems to be feasible.

(3) Integration and/or Conversion Strategy [+]. The required technical level for being able to support and maintain existing systems is lower than the competence required to develop and produce new ones. This makes the integration approach especially suitable for this kind of work. A company moving towards civilian production could maintain the required competence level in the field of military maintenance and support relatively easily. This competence could be mutually beneficial to the field of maintenance and support in the civilian sector. Another possibility that could be a result of more civilian components in military systems is that industries working entirely in the civilian field could have the skill necessary to maintain certain military systems, especially those containing a relatively high amount of civilian components and technology. So, even if the industry fails to maintain the necessary skill for developing new systems, it will be able to support the systems in the inventory.

6. Criteria VI: Limit Foreign Dependence

a. Description of Criteria

In today's market place, all countries must accept some degree of foreign dependence. Even U.S. industry faces this fact. The question is how much dependence the country will allow. Sweden has always had a degree of foreign dependence. The country's industrial base is too small to produce all necessary components and sub-systems domestically. As a consequence, the Swedish Defense Industry has become a very competent system builder, often using imported components to produce approximately 70 % of the major weapon systems for the Swedish Armed Forces.

However, as a result of decreased funding, Sweden faces a new challenge. Is it acceptable that products that always have been developed and produced in Sweden must now be procured abroad? The answer has not yet become clear. It is clear that Swedish government policy will attempt to maintain some degree of self sufficiency, especially in light of the neutrality policy. Furthermore, in future times of global crisis and mobilization, the declining defense infrastructure among major arms producers might leave no excess capacity for acquisition by a small country such as Sweden. As occurred in World War II, the larger countries might choose to restrict exports and retain all arms production for their own use.

b. Evaluation of Strategy

(1) International Cooperation Strategy [o]. The cooperation strategy makes the Swedish Armed Forces more openly dependent on foreign sources, with regard to both the number of foreign companies involved and Swedish dependence on subcontractors abroad. On the other hand, cooperation makes products more affordable and increases the size of the export market. This will help the domestic industry to stay competitive and survive as a part of a larger organization. This strategy can be described as foreign dependence on countries Sweden has established good relationships with and can

trust. The Swedish Defense Industry will most probably be able to continue to develop and produce competitive systems for the Swedish Armed Forces, or at least produce Swedish versions of systems jointly developed. This reduces the need for acquisition from entirely foreign companies.

(2) Consolidation and Concentration Strategy [o]. Under this strategy, some major weapon systems can still be bought from Swedish sources. Even though this strategy provides the greatest degree of independence from foreign sources for those Swedish companies that survive, it is important to note that even the survivors will be dependent, to some extent, on foreign sources for some materials and subcomponents. In cases where suppliers are incorporated in the company, this dependence will be significantly reduced. In other areas where Swedish companies cannot survive and domestic capacity is lost, weapon systems must be bought from abroad. There will be instances in which this procurement will not involve a Swedish company. In this case, the only possibility to reduce the dependence is to make an offset agreement.

(3) Integration and/or Conversion Strategy [o]. Not all Swedish firms will be able to utilize this strategy successfully. There will be areas in which domestic capacity will be lost and systems must be bought from foreign suppliers without Swedish involvement, although these occurrences will be less common than in the case of the consolidation and concentration strategy. The positive side of this strategy is that some companies still will be able to participate as subcontractors to other defense industries. There is also a possibility that the increased use of civilian components will reduce dependence on foreign sources.

E. SUMMARY

As expected, none of the strategies alone fulfills all “requirements.” In some cases it is difficult to assess how a particular strategy would develop. Table 4 is a summary of the results:

| Criteria | Strategy | | |
|---|---------------------------|-----------------------------|------------------------|
| | International Cooperation | Consolidation Concentration | Integration Conversion |
| I. Provide Competitive Systems | + | 0 | 0 |
| II. Support Build-up and Mobilization | + | 0 | 0 |
| III. Sustain a Broad Defense Industrial Base | + | - | 0 |
| IV. Provide Classified Technology | 0 | + | 0 |
| V. Support Systems in Inventory | + | 0 | + |
| VI. Limit Foreign Dependence | 0 | 0 | 0 |

Table 4. Summary

International Cooperation Strategy's greatest advantage is that it probably will maintain a broad base of companies capable of providing competitive military systems for the Swedish Armed Forces and support build-up and mobilization. On the other hand, there

will be more foreign involvement. Thus, although there will be greater access to top of the line equipment, Swedish companies will not always be able to retain the stand-alone capability to domestically produce such equipment. This strategy has the best chance of maintaining current structure.

Consolidation and Concentration Strategy will lead to the survival of a few highly qualified and competitive companies independent of foreign influence, capable of providing top of the line equipment for the Swedish Armed Forces in selected areas. For most companies, this approach is simply not possible, and competence will be lost. This strategy will in the areas of competence involve relatively few international firms, but it also poses the risk for depending on foreign sources for entire systems.

Integration and/or Conversion Strategy could, if successfully implemented, lead to effective, fast acting and flexible companies. The strategy seeks to integrate civilian components and processes into the production, in order for the companies to become more competitive. New civilian products can be produced as a complement to current products or as a replacement for military orders. A positive outcome of this strategy is that some companies will successfully adopt civilian processes and components and become more competitive, thereby simultaneously reducing dependence upon and improving their capability to respond to Swedish military requirements.

REFERENCES

1. Rapp Johan, Sweden takes its first steps toward finding a few allies, Jane's Defence Weekly, December 31, 1994, p. 39
2. Rapp Johan, Sweden takes its first steps toward finding a few allies, Jane's Defence Weekly, December 31, 1994, p. 39
3. U.S Congress, Office of Technology Assessment, Building Future Security, 1992 p. 13
4. U.S Congress, Office of Technology Assessment, Building Future Security, 1992 p. 15

VIII. CONCLUSIONS

This study has discussed the changed geopolitical context resulting from the collapse of the Soviet Union and the end of the cold war, and the new environment this development created for the world defense industry, especially in the case of Sweden. Despite these developments and a long history of declining defense spending, the Swedish defense budget has been able to sustain - up until now - a broad, world-class defense industry.

The government proposal for the 1996 defense decision, with significant reductions in both the size of the Armed Forces and the defense budget, will affect both ongoing and planned acquisition programs. Since the defense industry, to a large extent, depends on the domestic market (70% of domestic military production goes to the Swedish Armed Forces), further reductions are likely to have a significant impact. Since there is no other market to readily absorb the excess production, it will be necessary for the defense industry to change and adapt to the new reality.

There are two principal methods to deal with the situation. First, industry may initiate a variety of options to restructure itself. The other possibility is that the government initiates or subsidizes the restructuring process by supporting selected industries. This study was limited to the first approach.

This study evaluated three different industry-initiated strategies using the future needs of the Swedish Armed Forces to establish comparison criteria. These needs are expressed in official documents published by both the government and the Armed Forces. Future needs have also been communicated to Swedish industry in an attempt to facilitate the restructuring process and to provide industry with a clear picture of its largest customer's future priorities. In response to this clear overall trend of declining spending, some measures have already been taken by the Swedish Defense Industry. As a result, there are today a number of ongoing efforts in the areas of international cooperation, consolidation and conversion.

The outcome of the comparison of the strategies is summarized below:

A. INTERNATIONAL COOPERATION STRATEGY

- Is able to provide competitive systems in many areas
- Is able to support build-up and mobilization
- Maintains a broad industrial base
- Is able to support systems in inventory
- Creates known dependence and relationships
- Gains access to a larger market, thus lowering costs
- May increase specialization and foreign dependence
- May not be able to provide unique/classified technical solutions
- Will not consistently provide top-of-the-line stand-alone capability

B. CONCENTRATION AND CONSOLIDATION STRATEGY

- Maintains a few stand-alone, top-of-the-line companies
- Is able to provide unique/classified technology
- Reduces foreign dependence in selected areas
- Increases efficiency and lowers production costs
- Is able to support build-up and mobilization in selected areas
- Is able to support systems in inventory in selected areas

- Creates increased foreign dependence in abandoned areas
- Will not be able to provide competitive systems in all areas
- Will not maintain a broad base

C. INTEGRATION AND/OR DIVERSIFICATION STRATEGY

- Is able to support systems in inventory
- Maintains a relatively broad and flexible base for growth in most areas
- Increases efficiency and lowers costs
- Is able to support build-up and mobilization in most areas
- May not be able to provide unique/classified technical solutions
- Will not consistently provide top-of-the-line stand-alone capability
- Is not applicable in all areas

The evaluation shows that no strategy fulfills all requirements. International cooperation is the strategy that best meets the future needs of the Swedish Armed Forces. In addition, the international cooperation strategy contributes to shared costs, long production runs and a large customer base. This strategy provides the best opportunity to maintain a broad industrial base. Consequently, international cooperation is a necessary ingredient in the adapting process. If international cooperation can be achieved by simultaneously establishing a strong consolidated position, this combination strategy might prove even more successful by increasing Swedish industry's role in cooperative projects.

Concentration, however, can only be successful in selected areas. These are areas which, at least over a transition period, need continuous domestic support. If this support comes in the unlikely form of sustained or additional government spending in support of key

research and development, there is strong potential for increased leverage for Swedish defense industry in the international marketplace and the resulting economic benefits. On the other hand, if this support must come from the existing defense budget, it is clear that the funds will be taken from existing priorities, with a resulting decline in the industrial base supporting those areas, and further subsequent repercussions throughout the Swedish economy. Nonetheless, concentration is the only strategy capable of providing stand-alone top-of-the-line technology and systems that other countries will not export.

The importance of incorporating civilian technology and processes cannot be overstated. The integration and conversion strategy not only lowers costs, but gains access to new state-of-the-art technology, since civilian technology is often at the forefront. Moreover, the effort to counter new threats, such as international terrorism and smuggling, will offer opportunities for competent defense industries to develop new products for new markets. For certain firms the new market will be more vibrant than the military market and conversion would be the logical choice. This strategy alone cannot possibly preserve the entire defense industrial base and meet all Swedish defense requirements. However, the integration and conversion strategy improves efficiency as well as flexibility, and should be included as an important component of any overall strategy.

The comparison also shows that each of the three strategies contains measures that would increase the companies' competitiveness in different ways. It is possible to increase international cooperation and at the same time move toward more civilian processes. It is also possible to seek international cooperation from a strong stand-alone position. Cost cutting can and must be made regardless of the strategy chosen, although cuts will be more severe in the case of consolidation, in which whole areas may be abandoned.

No strategy eliminates foreign dependence. Dependence on foreign sources is inevitable due to the globalization of markets. The only choice to be made is between the two different types of dependency. International cooperation leads to a planned type of dependence which retains influence with joint partners in most areas. Consolidation may lead

to less dependence in selected areas, but greater dependence and total loss of leverage in areas where the competence is lost.

After reviewing the results of the evaluation, it is obvious that Sweden faces a dilemma. The stakes are high. Not only jobs are at stake, but also one of the traditional cornerstones of Swedish defense policy, the self-sufficiency regarded as necessary to maintain a credible defense and true neutrality. The challenge is to maintain a broad defense industrial base while guaranteeing access through domestic availability to top-of-the-line military technology. This ideal is impossible given current spending levels. Priorities must be assigned, and the government must make the decisions. It is also necessary for the Armed Forces to participate in this process in order to make sure that the defense industry structure fulfills the Armed Forces needs. This decision process will be most difficult, but the information is absolutely necessary in order for the industry to choose the best strategy in the restructuring process.

The Swedish Defense Industry must choose its own strategy to adapt to the new environment. The final overall strategy may include elements of all three strategies, but given foreseeable spending levels, it is impossible to pursue all three strategies simultaneously. It therefore falls on the government and the Armed Forces to "lay the ground rules" and clearly communicate future Armed Forces priorities and requirements. If this is done with an open and constructive dialogue, and skillfully managed by the industry and Armed Forces leadership, the Swedish Defense Industry will have all the necessary ingredients not only to survive, but also to thrive in the new environment, continuing to form an important foundation for Swedish security policy.

BIBLIOGRAPHY

- Association of Swedish Defence Industries, *The Swedish Defence Industry*, 1994, p. 4
- Bitzinger, Richard A., *The globalization of arms production: defense markets in transition*, Defense Budget Project, 1993, p. 1
- Defence Made in Sweden*, speeches by Defence Minister Mr. Anders Bjorck, Ministry of Defence, 1994
- Edgar, D. Alistair, Haglund, G. David, *The Canadian Defence Industry in the New Global Environment*, Queens, 1995
- Eriksson, Johan, *Stat och forsvarsindustri i Västeuropa: relationer i förändring*, FOA underlagsrapport, D 10259, November 1992
- Fakta om totalforsvaret 1995*, Forsvarsmakten, 1995, p. 33
- Forsvarsmaktsplan 95*, Huvuddokument, Forsvarsmakten, Stockholm, 1994
- Gregory, H. William, *The Price of Peace*, Lexington Books, 1993
- Gunnarsson, Pierre, *Forsvarsindustriellt samarbete i Västeuropa: organisationer och drivkrafter*, Forsvarets forskningsanstalt, 1990, p. 83
- Hagelin, Bjorn, *Neutrality and foreign military sales*, Westview Press, 1990
- IEEE Spectrum*, Vol. 26, No. 11, November 1989, p. 4
- Klare, Michael T., "The Next Great Arms Race", *Foreign Affairs*, Volume 72 No. 3, p. 148
- Ljungfelt, Lennart, *Svensk vapenexport i framtiden?*, Militärhögskolan, enskild utredning, Dec 16, 1994, p. 14
- Moteff, John D., *Defense Technology Base Programs and Defense Conversion*, Congressional Research Service, April 6, 1995, p. 6
- Report of the CSIS Steering Committee on Security and Technology, *Integrating Commercial and Military Technologies for National Strength*, The Center for Strategic & International Studies Washington, D.C., March 1991, p. ix
- Sandstrom, Madelene, Wilen, Christina, Ahlstrom, Magnus, *Forsvarsindustri i förändring*, Forsvarets forskningsanstalt, 1991, p. 16
- Strang, D., Hedberg, L., Jonsson, U., *Utveckling av anslag, sysselsättning och kompetens vid FOA och FMV samt utveckling av materielanslag och forsvarsindustri*, FOA underlagsrapport, D 10246, June 1992
- Sverige i Europa och världen*, Forsvarsdepartementet, Ds 1995:28, p. 96
- "Totalforsvarets utveckling och fornyelse, rapport från forsvarsberedningen", Forsvarsdepartementet, Ds 1995:51, pp. 92-96

Wetterqvist, Fredrik, *Forsvarsindustriellt samarbete i Europa - organisationen IEPG*, FOA rapport, A 10032-1.3, July 1992

U.S Congress, Office of Technology Assessment, *Building Future Security*, 1992 p. 27

Wilen, Christina, *Internationellt samarbete inom robotindustrin*, Forsvarets forskningsanstalt rapport, A 10035-1.3, September 1992

_____, *Euromissile och Trigat*, FOA rapport, A 10053-1.3, February 1994

Wulf, Herbert, "Arms Industry Limited: The Turning-Point in the 1990's", *Arms Industry Limited* (Oxford: Oxford University Press, 1992), p. 18

INITIAL DISTRIBUTION LIST

| | No. Copies |
|---|------------|
| 1. Defense Technical Information Center 8725 Kingman Rd., STE 0944 Ft. Belvoir, VA 22060-6218 | 2 |
| 2. Library, Code 13 Naval Postgraduate School Monterey, CA 93943-5000 | 2 |
| 3. Professor Roger D. Evered, Code AS/Ev Systems Management Department Naval Postgraduate School Monterey, CA 93943-5101 | 1 |
| 4. Lieutenant Colonel Keith Snider, Code SM/Sk Systems Management Department Naval Postgraduate School Monterey, CA 93943-5101 | 3 |
| 5. Major Staffan H. Sjoberg Sandelsgatan 9 S-11534 Stockholm Sweden | 2 |